

DEEP-SEA HOLOTHUROIDS TAKEN BY THE R.V. *AFRICANA II*
IN 1959, FROM OFF THE WEST COAST OF THE
CAPE PENINSULA, SOUTH AFRICA

By

AHMED S. THANDAR

Department of Zoology, University of Durban-Westville, Durban, South Africa

(With 16 figures and 2 tables)

[MS accepted 11 June 1998]

ABSTRACT

Some 106 specimens of deep-sea holothuroids taken by the R.V. *Africana II* cruises off the west coast of the Cape Peninsula, South Africa, in 1959 by the then Division of Sea Fisheries, are diagnosed and/or described.

The material is distributed over 10 families, 13 genera, 15 nominal and two indeterminate species, and includes three recently described species (Thandar 1998), a new species, *Molpadia millardae*, and nine new records for the southern African region, south of the tropic of Capricorn. Previous records of *Echinocucumis typica* sensu Clark, 1923 (*non* Sars, 1859), and *Sphaerothuria talismani* (partim) sensu Deichmann, 1930 (*non* E. Perrier, 1886), are based on misidentifications of *Ypsilothuria bitentaculata* (Ludwig, 1893).

CONTENTS

	PAGE
Introduction	364
R.V. <i>Africana II</i> stations, species and other data	364
Methods	366
Systematic account	366
Family Psolidae R. Perrier, 1902	366
Family Cucumariidae Ludwig, 1894	368
Family Vaneyellidae Pawson & Fell, 1965	369
Family Ypsilothuriidae Heding, 1942	369
Family Synallactidae Ludwig, 1894	376
Family Deimatidae Ekman, 1926	379
Family Laetmogonidae Ekman, 1926	381
Family Psychropotidae Théel, 1882	382
Family Elpidiidae Théel, 1879	389
Family Gephyrothuriidae Koehler & Vaney, 1905	396
Family Molpadiidae Müller, 1850	399
Acknowledgements	406
References	407
Abbreviations	409

INTRODUCTION

Numerous specimens plus some fragments of deep-sea holothuroids taken during the months of August and December 1959, by the then Division of Sea Fisheries' R.V. *Africana II* routine cruises off the west coast of the Cape Peninsula, South Africa, have until now remained undescribed. The material was deposited in the South African Museum (SAM). Subsequently, most of the material was sent to the late Dr Cherbonnier of the Museum National d'Histoire Naturelle, Paris (MNHN) for identification and reporting. Duplicates of the samples and some other remaining material was loaned to the author for inclusion in his monograph of the southern African Holothuroidea that was being prepared for a doctoral thesis. The thesis was completed some time ago (see Thandar 1984) but the results of the R.V. *Africana II* collections were not published, awaiting a report of the material at the MNHN. Since no report was forthcoming and after the retirement of Dr Cherbonnier, the writer asked the SAM to request a return of the specimens from France. This was acceded to and on their arrival the specimens were forwarded to the writer.

All the R.V. *Africana II* material was collected with a 15-foot beam trawl from nine deep-sea localities off the west coast of the Cape Peninsula between latitudes 33°26'S and 34°42'S and longitudes 16°15'E and 17°21'E, in water depths ranging from 2 269 to 3 257 m. All material studied is deposited in the SAM, under SAM-A catalogue numbers. The R.V. *Africana II* stations, the species taken from each station and other pertinent data are listed below. Full station lists and other data for the period 1 April 1959 to 31 March 1960 can be found in the Division of Sea Fisheries Annual Report (Anon. 1963: 204-213).

R.V. *AFRICANA II* STATIONS, SPECIES AND OTHER DATA

- A 190, west of Dassen Island, 33°26'S 16°33'E, 26 August 1959, 2 268-2 377 m.
 SAM-A22149, *Ypsilothuria bitentaculata* (Ludwig), 13 specimens.
 SAM-A27715, *Elpidia gracilis* Belyaev, 1 specimen and 2 fragments.
- A 191, west of Dassen Island, 33°36'S 16°15'E, 26 August 1959, 2 780-2 871 m.
 SAM-A22165, *Laetmogone perplexa* Thandar, 1998 (holotype), 1 specimen.
 SAM-A27716, *Benthodytes lingua* R. Perrier, 1 specimen.
 SAM-A27717, *Benthodytes valdiviae* Hansen, 2 specimens.
 SAM-A22175, *Benthodytes ?typica* Théel, 1 specimen.
- A 193, west of Cape Town, 33°50'S 17°21'E, 26 August 1959, 2 268 m.
 SAM-A22147, *Scotoplanes globosa* Théel, 4 specimens.
- A 315, west of Cape Point, 34°37'S 17°03'E, 8 December 1959, 2 890-2 963 m.
 SAM-A27718, *Echinocucumis hispida* (Barrett), 1 specimen.
 SAM-A22150, *Ypsilothuria bitentaculata* (Ludwig), 7 specimens.
 SAM-A22169, *Molpadia millardae* sp. nov., 1 specimen (paratype).

- A 316, south-west of Cape Point, 34°42'S 16°54'E, 8 December 1959, 3 155–3 255 m.
SAM-A22146, *Paracucumaria capense* Thandar, 1998, 2 specimens.
SAM-A27719, *Psolidium vitreum* Ohshima, 1 specimen.
SAM-A22155, *Psolidothuria octodactyla* Thandar, 1998, 1 specimen.
SAM-A22145, *Psolidothuria octodactyla* Thandar, 1998, 1 specimen.
SAM-A22130, *Echinocucumis hispida* (Barrett), 3 specimens.
SAM-A22142, *Echinocucumis hispida* (Barrett), 1 specimen.
SAM-A22143, *Echinocucumis hispida* (Barrett), 3 specimens plus fragments.
SAM-A22158, *Orphnurgus protectus* (Sluiter), 1 specimen.
SAM-A22156, *Meseres atlanticus* (R. Perrier), 2 specimens.
SAM-A22172, *Peniagone* sp. indet., 1 specimen.
- A 317, west of Saldanha Bay, 33°15'S 16°30'E, 8/9 December 1959, 2 708–3 038 m.
SAM-A22151 *Ypsilothuria bitentaculata* (Ludwig), 1 specimen.
- A 318, west of Cape Peninsula, 33°52'S 16°51'E, 9 December 1959, 2 524–2 780 m.
SAM-A22166, *Paracucumaria capense* Thandar, 1998, 1 specimen.
SAM-A27722, *Paracucumaria capense* Thandar, 1998, 3 specimens.
SAM-A22164, *Psolidothuria octodactyla* Thandar, 1998, 1 specimen (holotype).
SAM-A27710, *Psolidothuria octodactyla* Thandar, 1998, 2 specimens (paratypes).
SAM-A27590, *Psolidothuria octodactyla* Thandar, 1998, 3 specimens.
SAM-A27720, *Echinocucumis hispida* (Barrett), 1 specimen.
SAM-A27721, *Echinocucumis hispida* (Barrett), 4 specimens.
SAM-A22167, *Echinocucumis hispida* (Barrett), 2 specimens.
SAM-A22132, *Ypsilothuria bitentaculata* (Ludwig), 6 specimens.
SAM-A22144, *Ypsilothuria bitentaculata* (Ludwig), 2 specimens.
SAM-A22168, *Molpadia millardae* sp. nov., 2 specimens.
- A 319, west of Cape Town, 34°05'S 16°58'E, 9 December 1959, 2 688–2 725 m.
SAM-A27723, *Echinocucumis hispida* (Barrett), fragment.
SAM-A22139, *Ypsilothuria bitentaculata* (Ludwig), 10 specimens plus fragment.
SAM-A22140, *Gephyrothuria alcocki* Koehler & Vaney, 2 specimens.
SAM-A22174, *Molpadia millardae* sp. nov., 1 specimen.
SAM-A22141, *Molpadia* sp. indet., 2 specimens.
- A 322, south-west of Cape Point, 34°36'S 17°00'E, 10 December 1959, 2 743 m.
SAM-A22148, *Ypsilothuria bitentaculata* (Ludwig), 12 specimens.
SAM-A22163, *Molpadia millardae* sp. nov., 1 specimen (holotype).
SAM-A27711, *Molpadia millardae* sp. nov., 3 specimens (paratypes).

METHODS

The specimens were studied according to conventional methods outlined by Fisher (1907), Deichmann (1948), and Rowe & Doty (1977). The spicules were removed in antiformin (see Mahoney 1966), washed in two changes of distilled water, and illustrated with a *camera lucida*.

For scanning electron microscopy the spicules were transferred, through two changes of absolute alcohol, on to a specimen stub to which they normally stick once the alcohol evaporates. They were then sputter-coated with gold at 30–40 mA for 5 minutes and photographed using the Philips SEM 500.

Although all the available data for the new species described herein are repeated in the text under 'Material examined', for the remaining species only the locality data are given in the text and then by reference to latitude/longitude degree squares as was previously done by the writer (Thandar 1984, 1991), following Day's (1967) method for the polychaetes. The letters WCP denote Western Cape Province and vd, very deep (> 500 m).

SYSTEMATIC ACCOUNT

Order DENDROCHIROTIDA Grube, 1840

Family **Psolidae** R. Perrier, 1902

Psolidium vitreum Ohshima, 1915

Figs 1, 16B

Psolidium vitreum Ohshima, 1915: 281, pl. 11 (fig. 32).

Psolus sp. Théel, 1886: 15 (*syn. nov.*).

Diagnosis (after Ohshima 1915: 281)

Body form elliptical, mouth and anus on conical prominences. Colour white, glassy. Ventral pedicels in zigzag row on each ambulacrum on margin of sole, few also in odd ambulacrum. Dorsal pedicels minute. Sole deposits round to oval, often overlapping, faintly knobbed plates, up to 0.40 mm in diameter, with large, regularly arranged holes (up to 36), partially or completely occluded in larger specimens, size of plates and number of holes increasing with age. Dorsal scales thin, smooth, rounded, imbricating, 1.0–1.5 mm in diameter, some with holes for dorsal pedicels. Ventral pedicels with end-plates and other curved, elongated plates with two series of holes; dorsal pedicels with reduced end-plates and supporting rods. Plates of tentacles similar to those of pedicels but broader, with more holes.

Previous southern African record

None.

Material examined

SAM-A27719, WCP (34/16/vd), 1 specimen.

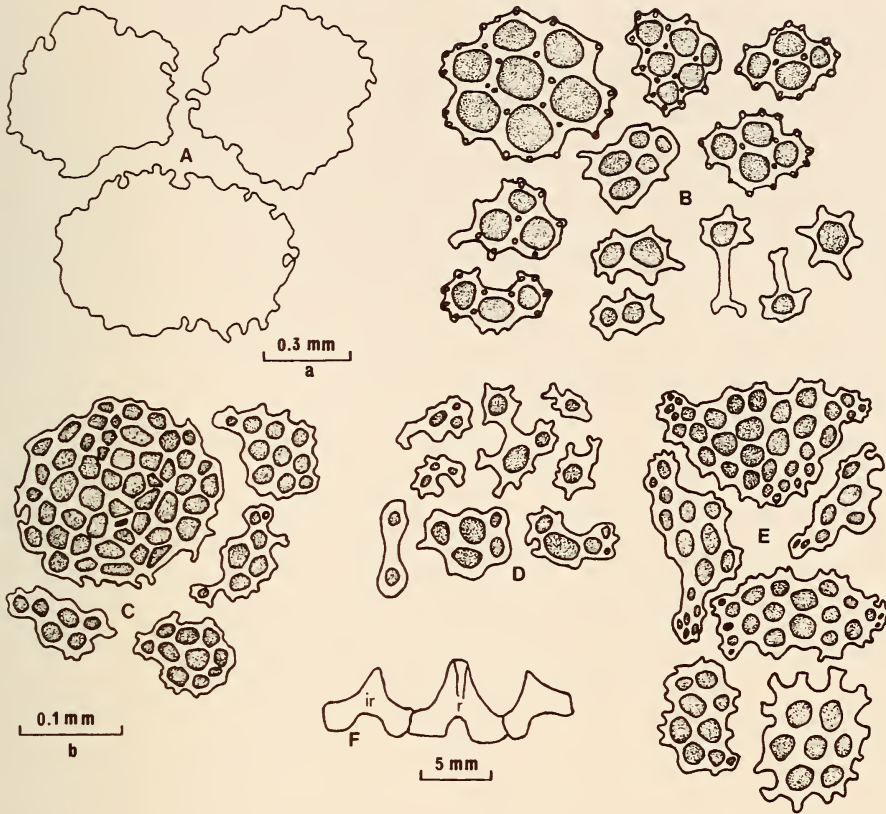


Fig. 1. *Psolidium vitreum* Ohshima. Spicules and calcareous ring. A. Scales from dorsal wall. B. Deposits from sole. C. End plate and other perforated plates from ventral podia. D. Plates and rods from dorsal podia. E. Tentacle plates. F. One radial and two interradial plates of calcareous ring. A—scale a; B—E—scale b.

Description

Form cylindrical, dorsal surface arched, ventral flattened, damaged. Length 10 mm, width in mid-body 3 mm. Colour white, in alcohol. Anterior and posterior ends turned up, mouth and anus dorsal, oral and anal cones not conspicuous; anus surrounded by five calcareous plates, each flanked by anal papillae. Tentacles 10, eight large and bushy, ventralmost two very much reduced. Sole displaced anteriorly, oval, 3.5 mm in length, bordered by a rim of well-developed pedicels in a single zigzag row in each ventrolateral ambulacrum, none detected in damaged odd ambulacrum; total number of ventral pedicels 18. Dorsal pedicels minute, scarce.

Alimentary canal lost; polian vesicle and stone canal not seen. Calcareous ring (Fig. 1F) simple, radial and interradial plates with pointed anterior projections, interradial plates about two-thirds the size of radial plates, latter with anterior depression for insertion of retractor muscle; posterior surface of radial plates deeply notched, that of interradial plates concave. Gonad

immature. Respiratory trees as paired, simple tubes, each branched dichotomously once.

Dorsal scales (Figs 1A, 16B), circular but imbricating, up to 1 mm in diameter, made up of more than one layer of calcareous material. Sole deposits (Fig. 1B) as rods and usually faintly knobbed, perforated plates, 0.095–0.15 mm long (mean 0.12 mm); holes large, 1–7 in number, knobs along margin of plates and on surface; usually only a few of the smaller plates smooth. Ventral pedicels with well-developed end-plates and other smooth perforated plates (up to 0.14 mm long), of various shapes and irregular margins (Fig. 1C). Dorsal pedicels with reduced end-plates and other smooth irregular plates with one or more holes, often curved and basket-like (Fig. 1D). Tentacles with plates similar to those of ventral pedicels, but larger, up to 0.25 mm in length, and with more numerous holes (Fig. 1E).

Remarks

Ohshima (1915) compared his species from the North West Pacific with *Psolidium dorsipes* Ludwig from the South East Pacific, pointing out several differences between the two. He further commented that *Psolus incertus* Théel from Kerguelen Island and *Psolus* sp.—a defective specimen described by Théel (1886) from the Gulf of Mexico—are also close to *P. vitreum*. Whereas *Psolus incertus* clearly belongs in the genus *Psolus*, the presence of dorsal pedicels ('flexible cylindrical appendages' of Théel 1886: 16) in *Psolus* sp., clearly places it in the genus *Psolidium*. From the brief description given by Théel, it appears that, apart from the arrangement of ventral pedicels in double rows and the absence of pedicels in the odd ambulacrum, there appear to be no other differences between *Psolus vitreum* and the specimen collected by S.S. Blake, to which it is here referred. The southern African specimen similarly differs from the type of the species only in the absence of pedicels in the odd ambulacrum (perhaps an age variation). One other species, namely *P. disjunctum* Sluiter from the tropical West Pacific, is also similar to *P. vitreum* but its dorsal pedicels are stated to be in double rows and ventral in three rows.

Distribution

Known from Japan, the Gulf of Mexico, and south-west coast of Africa, 184–3 255 m.

Family Cucumariidae Ludwig, 1894

Paracucumaria capense Thandar, 1998

Fig. 15B

Trachythyone ?parva Thandar, 1991 (non Ludwig): 134, figs 11, 15.

Paracucumaria capense Thandar, 1998: 83, figs 2c–e, 3a–e.

Diagnosis (from Thandar 1998)

Small, somewhat U-shaped species, up to 36 mm in length along ventral surface. Colour, in alcohol, uniformly white. Pedicels restricted to ambulacra in

double rows, sometimes a few also scattered in interambulacra of dorsal surface. Tentacles 8–10, of more or less equal size. Radial plates of calcareous ring blunt, without incisions but with concave posterior margins. Body wall spicules a superficial layer of baskets, usually confined to anal region, rarely occurring elsewhere, and an inner layer of large, irregular, smooth to faintly nodular, imbricating plates with up to 12 large holes. Pedicels with mostly perforated, sometimes knobbed, irregular rods and plates, end-plates reduced. Tentacle deposits similar but larger. Introvert with perforated plates of varying shapes, margins jagged or knobbed, surface finely knobbed.

Remarks

This species was identified as *Trachythyone ?parva* by Thandar (1991) but, after examination of the additional specimens received from the MNHN, it became obvious that the material does not represent a *Trachythyone* but a new species of *Paracucumaria*, recently described by Thandar (1998) and compared with other nominal species of the genus.

Order DACTYLOCHIROTIDA Pawson & Fell, 1965

Family Vaneyellidae Pawson & Fell, 1965

Psolidothuria octodactyla Thandar, 1998

Fig. 15A

Psolidothuria octodactyla Thandar, 1998: 80, figs 1a–f, 2a, b.

Diagnosis (from Thandar 1998)

Small, U-shaped dactylochirotid holothuroids with mouth and anus at opposite ends. Tentacles eight, unequal in size, finger-like but finely branched. Calcareous ring simple, consisting of eight, more or less similar plates without posterior prolongations. Thecal plates simple, imbricating, occasionally faintly nodular; holes few (up to 20), large, spires absent.

Remarks

This species was recently described by Thandar (1998), who also amended the diagnosis of the family Vaneyellidae and erected the new genus *Psolidothuria* to accommodate the new southern African form; hence only the diagnosis is repeated here. It appears that the new genus bridges the gap between the families Vaneyellidae and Ypsilothuriidae within the dactylochirotid holothuroids.

Family Ypsilothuriidae Heding, 1942

This family, when proposed by Heding (1942), included only the genera *Echinocucumis* and *Ypsilothuria*. However, Panning (1949) referred several other genera to it; subsequently Pawson (1965) restricted the Ypsilothuriidae to

include only three genera, namely *Echinocucumis* Sars, *Ypsilothuria* E. Perrier and *Ypsilocucumis* Panning. Of these, only the former two are represented in southern Africa and present in the collection here studied.

Genus *Echinocucumis* Sars, 1859

This genus includes ypsilothuriids with thecal plates made up of only a single layer of calcareous material. Currently only four species—the cosmopolitan type species *Echinocucumis hispida* (Barrett, 1856), the Western Indian Ocean *E. paratypica* Ludwig & Heding, 1935, and the Eastern Atlantic *E. tenera* Cherbonnier, 1958, and *E. multipodia* Cherbonnier, 1964, are included in the genus. The latter two species possess bifurcate processes to the calcareous ring and hence may not strictly belong in *Echinocucumis*.

Echinocucumis hispida (Barrett, 1856)

Figs 2, 14A–C

Eupyrgus hispidus Barrett, 1856: 46, pl. 4 (figs a–b).

Echinocucumis typica Sars, 1861: 102, pl. 10 (figs 11–20), pl. 11 (figs 1–17). Théel, 1886: 9, fig. 3.

Cucumaria typica Ludwig, 1901: 149.

non *Echinocucumis typica* Clark, 1923: 418 (= *Ypsilothuria bitentaculata* (Ludwig)).

Echinocucumis hispida Mortensen, 1927: 404, figs 242 (i), 243. Deichmann, 1930: 150, pl. 18 (fig. 9). Ludwig & Heding, 1935: 167. Heding, 1942: 29, figs 31, 32. Panning, 1949: 454. Pawson, 1965: 8, fig. 2.

Diagnosis (from Pawson 1965)

Tentacles 10, unequal in size. Body U-shaped, mouth and anus placed at ends of non-retractile tubes. Pedicels scarce, slender, thread-like, restricted to ambulacra. Body covered by large (c. 1 mm in diameter) scales with an excentric spire, placed near margin; scales with numerous regular holes and either single-layered or with a coarse reticulum spreading out from the base of spire and partially covering primary disc.

Previous southern African record

None.

Material examined

SAM–A22130, A22142, A22143, A22167, A27718, A27720, A27721, A27723; WCP (33/16/vd to 34/17/vd), 15 specimens plus fragments.

Description

Specimens typically U-shaped (Fig. 2A), largest 40 mm along greater curvature. Tentacles 10 (Fig. 2G)—in dissected specimens one on each side very long, four slightly smaller and four very small, two largest branched at base. Each respiratory tree (Fig. 2I) with two main trunks, one whitish, the other brownish, each trunk with short extensions (?caeca) and, in addition, short thread-like processes at base.

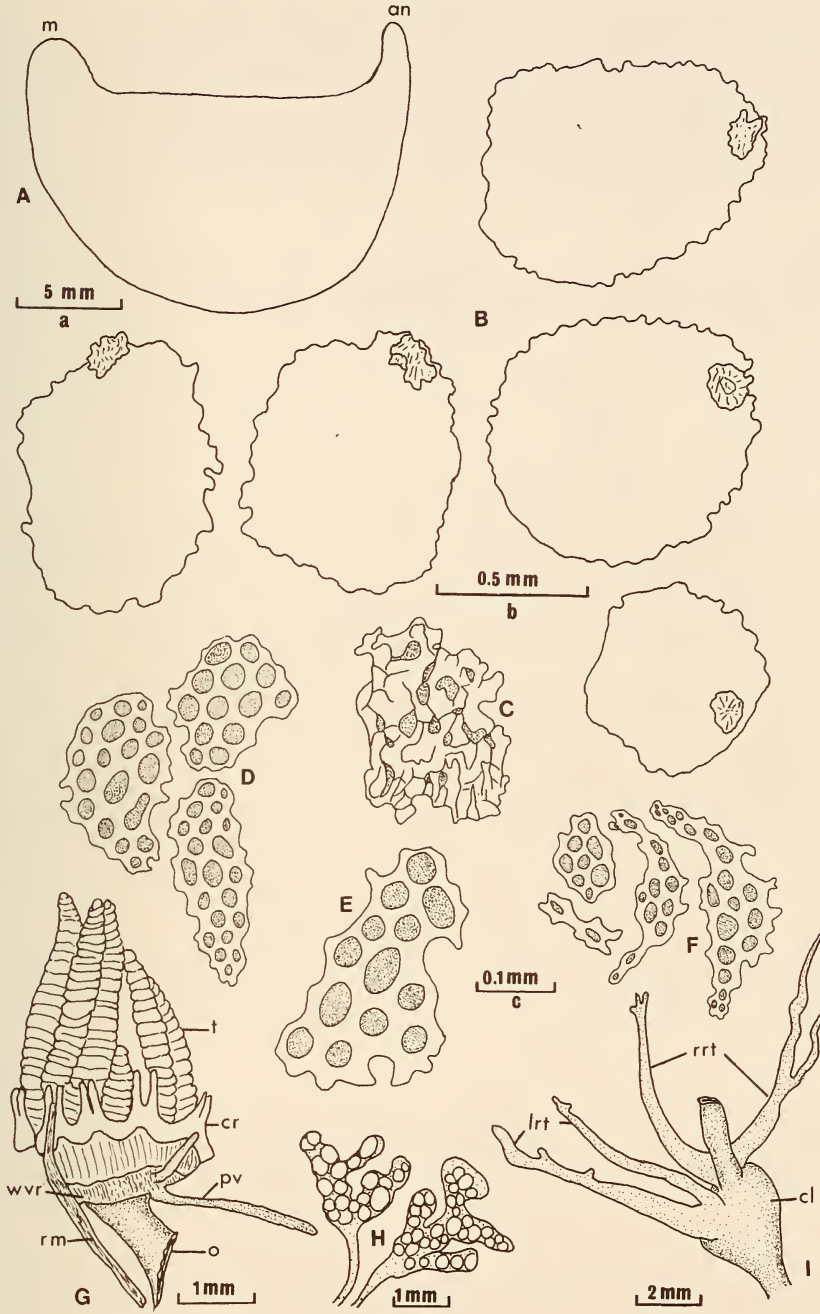


Fig. 2. *Echinocucumis hispida* (Barrett). Structure and spicules. A. Entire animal. B. Spired plates from body wall. C. Spire (from side). D. Smooth plates from oral siphon. E. Smooth plate from anal siphon. F. Tentacle plates. G. Calcareous ring and associated organs. H. Gonadal tubules of female. I. Cloaca with respiratory trees. A—scale a; B—scale b; C—F—scale c.

Thecal plates (Figs 2B, 14B) 0.60–0.90 mm, with a coarse reticulum spreading out from base of spire to partially cover primary disc. Spires (Fig. 2B, C) 0.165–0.270 mm, placed near margin, gradually lost towards oral and anal ends. Plates of anal siphon thick, holes large (Fig. 2E); those of oral siphon thin, holes small (Fig. 2D). Tentacles with plates and rods (Fig. 2F).

Remarks

Although the form of the specimens, the number of tentacles and the marginal spires suggest that the present material belongs in *Echinocucumis*, the base of the spire spreads out as a coarse reticulum partially covering the primary plate so that it appears as if part of each thecal plate is made up of more than one layer of calcareous material. Since a coarse reticulated network has also been described by Deichmann (1930) for *Ypsilocucumis asperrima* (Théel), one may be inclined to consider the present material as being identical with that species. The tentacle deposits also resemble those illustrated by Deichmann. However, judging from Théel's (1886) description of the holotype, it is certain that the thecal plates of *Y. asperrima* are clearly multilayered. In fact, Heding (1942: 27) commented that 'Deichmann did not distinguish clearly between the different forms of *Ypsilothuria* and *Echinocucumis*'.

The thecal plates of the present specimens in fact resemble those of *Ypsilothuria talismani talismani* E. Perrier, illustrated by Heding (1942: 28, fig. 27 (3)), more than any other ypsilothuriid. However, Heding stated that *Ypsilothuria* always has 8 tentacles and 8 plates to the calcareous ring. *Echinocucumis*, on the other hand, has 10 tentacles with 10 plates to the calcareous ring. If the number of tentacles is not of any great phylogenetic significance, as suggested by Deichmann (1930) (she noted that the two ventral tentacles may be aborted), then there appears to be some overlap of characters between the southern African *E. hispida* and *Y. talismani talismani*. As a point of interest, the spires in the southern African material are more excentric than those illustrated by Pawson (1965) for the New Zealand form.

According to both Sars (1861) and Heding (1942), the four dorsal tentacles always have two digits each, whereas the two large lateral ones are branched. In the present material, however, only the two largest tentacles have a few branches at their base. Nevertheless, unbranched tentacles have been described for the species by Deichmann (1930), who worked on Scandinavian material, and by Pawson (1965), who studied the New Zealand form.

The respiratory trees, unlike those described for the species by both Deichmann (1930) and Pawson (1965), are well developed, with separate origins, each supplied with two main stems and some supplementary branches. This observation is in agreement with that of Heding (1942).

The bathymetric range of *E. hispida*, according to Heding (1942), is 50–1 300 m. He stated that deeper records are those of *Y. talismani* and not *E. hispida*. However, Pawson's material from the eastern side of New Zealand came from a depth of 1 530 m. If the southern African material represents a true *E. hispida* then a depth of 2 525–3 257 m is the deepest yet recorded for the species. The structural differences between the southern African form and the

typical *E. hispida* may be ascribed to both geographic and depth variations. At least, at infraspecific level, distinction can be drawn between the North Atlantic, southern African, New Zealand and West Indian (forma *atypica* Deichmann, 1930) forms of the species, each possibly representing a subspecies.

Clark's (1923) specimens of *E. typica*, recorded from Cape Point, are herein re-identified as *Ypsilothuria bitentaculata* (see remarks under *Y. bitentaculata*).

Local distribution

Known only from off south-western Cape Province, 2 525–3 257 m.

General distribution

Cosmopolitan, 50–3 257 m.

Genus *Ypsilothuria* E. Perrier, 1886

Heding (1942) recognized only two species in this genus, namely *Ypsilothuria talismani* E. Perrier and *Y. bitentaculata* (Ludwig). According to him, *Y. talismani* has two Atlantic varieties (subspecies) whereas *Y. bitentaculata* has one Atlantic and two Indo-Pacific varieties (subspecies).

Ypsilothuria bitentaculata (Ludwig, 1893)

Figs 3, 14D–F

Sphaerothuria bitentaculata Ludwig, 1893: 112; 1894: 141, pl. 12 (figs 16–17), pl. 14 (figs 5–14). Deichmann, 1930: 152, pl. 19 (figs 4–5). Ludwig & Heding, 1935: 196, figs 55–57.

Ypsilothuria bitentaculata Koehler & Vaney, 1905: 87. Heding, 1942: 28, pl. 2 (figs 1–10), text-figs 25 (1–4, 9–10), 26 (4–7), 27 (2, 5), 30. Panning, 1949: 455. Pawson, 1965: 6, fig. 1 (2–5).

Echinocucumis typica Clark, 1923: 418 (non *Echinocucumis typica* Sars, 1859 = *E. hispida* Barrett, 1856).

Sphaerothuria talismani Deichmann, 1930: 154, pl. 19 (fig. 3) (*partim*) (non *Sphaerothuria talismani* (E. Perrier) = *Ypsilothuria talismani* E. Perrier).

Diagnosis

Globular to spherical ypsilothuriids with plates of body wall forming a rigid test almost as hard as a young echinoid; thecal plates with uneven margins and composed of several layers of calcareous material; holes reaching periphery of plates; spires never marginal in position.

Previous southern African record

WCP (34/18/vd) as *Echinocucumis typica* by Clark (1923), 1 647–1 830 m.

Material examined

SAM–A22132, A22139, A22144, A22148, A22149, A22150, A22151;
WCP (33/16/vd to 34/17/vd), 51 specimens plus fragments.

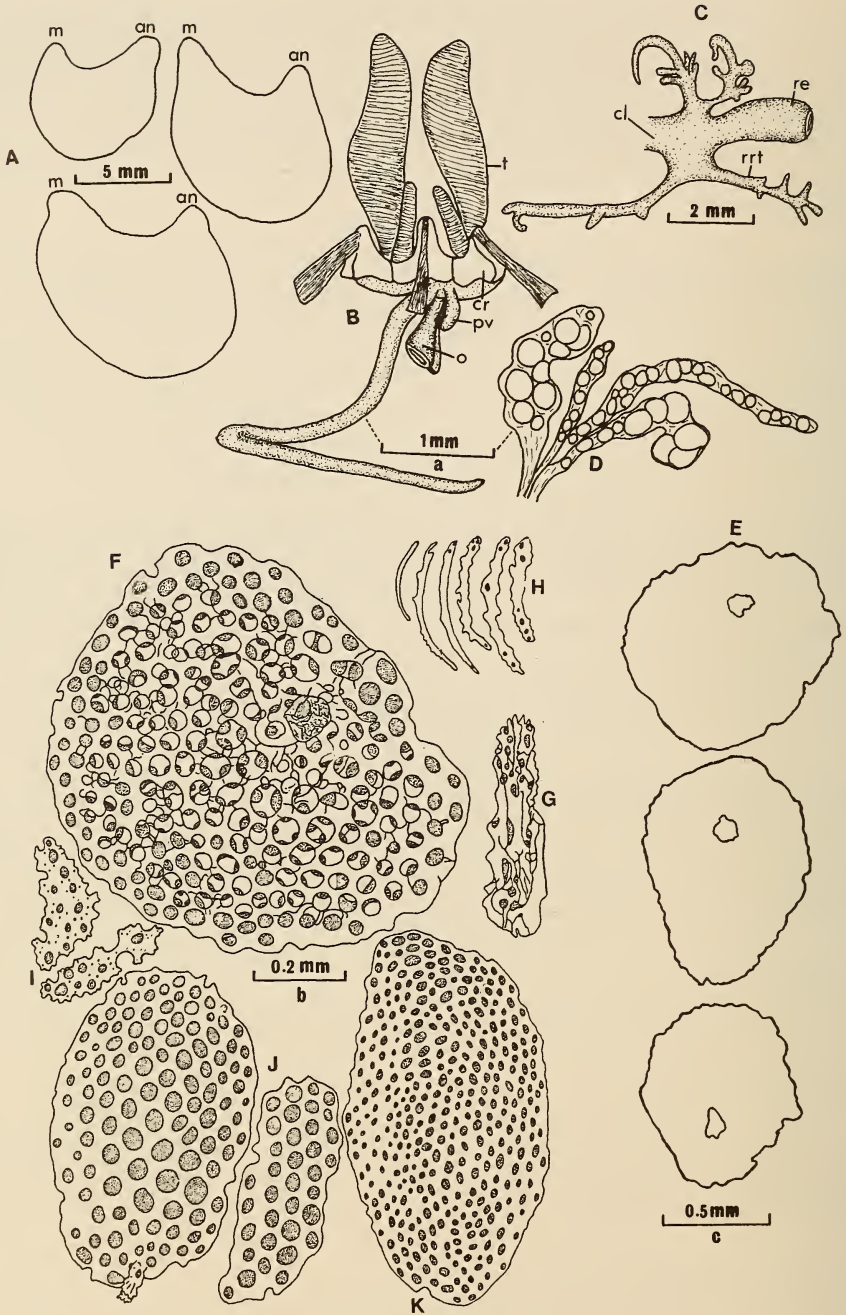


Fig. 3. *Ypsilothuria bitentaculata* (Ludwig). Structure and spicules. A. Entire animals. B. Calcareous ring and associated organs. C. Respiratory trees. D. Gonadal tubules of female. E. Spired plates of body wall. F. Detail of one spired plate. G. Spire (from side). H. Tentacle rods. I. Introvert plates. J. Plates from oral siphon. K. Plate from anal siphon. B, D—scale a; F—K—scale b; E—scale c.

Description

Specimens globular to spherical (Fig. 3A), largest 25 mm along greater curvature. Tentacles 7–8, unbranched (Fig. 3B), lateral two largest; of remaining tentacles, two dorsal and 3–4 ventral in position. Respiratory trees each with two main trunks, each trunk with sac-like extensions (caeca) (Fig. 3C).

Thecal plates (Figs 3E, F, 14D, E) 0.71–1.27 mm, multi-layered, spire up to 0.5 mm high (Fig. 3G), slightly excentric (Fig. 3E). Plates of oral siphon single-layered, with or without a spire (Fig. 3J); the latter, if present, marginal. Plates of anal siphon also single-layered with small, concentrically arranged holes (Fig. 3K). Tentacle rods curved, margins spinose (Fig. 3H). Introvert plates with minute nodules and jagged edges (Fig. 3I).

Remarks

Of the two species included in this genus there is no doubt that the present specimens belong to *Y. bitentaculata*. This is borne out by the shape and texture of the specimens, the form of the calcareous ring, and the structure of the thecal plates. According to Heding (1942), *Y. bitentaculata* is as rigid as a little echinoid, whereas *Y. talismani* is soft; the latter species is much smaller, reaching a length of 15 mm, whereas *Y. bitentaculata* reaches a length of 20 mm. Heding also stated that *Y. bitentaculata* always occurs at abyssal depths (true for the southern African material), whereas *Y. talismani* occurs in shallow waters.

The specimens agree well with Heding's (1942) description of *Y. bitentaculata attenuata* except that they reach a size of 25 mm, the thecal plates (0.7–1.3 mm) are smaller than those recorded for the variety (1.2–1.8 mm), and the tentacle spicules resemble those of *Y. talismani talismani* illustrated by Heding rather than those of his *Y. bitentaculata attenuata*. Perhaps not all these differences are significant as the size of the animal may vary depending on the method of measuring, and the tentacle deposits may differ from the base of a tentacle to the tip. The present specimens are not referable to the Indo-Pacific *Y. bitentaculata bitentaculata* since Heding stated that the size of the plates in this form exceeds 1.8 mm.

Clark (1923) recorded two spherical forms collected by the R.V. *Pieter Faure* from Cape Town in 1916 as *Echinocucumis typica* (= *E. hispidata*). Deichmann (1930), who re-examined one of Clark's specimens, referred it to *Sphaerothuria* (= *Ypsilothuria*) *talismani*, although she described the body as spherical, a shape typical for *Y. bitentaculata*. According to Heding, *Y. talismani* is oblong-spherical with a thin soft body wall similar to *E. hispidata*. A dry specimen in the SAM type collection, labelled as *E. typica*, is possibly one of the specimens examined by Clark. Judging from its size, shape and external structure it is indistinguishable from *Y. bitentaculata* described herein. Hence *E. typica* Clark, 1923 (*non* Sars, 1861) and *S. talismani* (*partim*) Deichmann, 1930 (*non* E. Perrier, 1886), are here re-identified as *Y. bitentaculata*.

Local distribution

Known only from off south-western Cape Province, 1 647–2 965 m.

General distribution

Possibly cosmopolitan, 375–3 231 m.

Habitat

Green mud.

Order ASPIDOCHIROTIDA Grube, 1840

Family Synallactidae Ludwig, 1874

Meseres atlanticus (R. Perrier, 1902)

Figs 4, 16A

Pseudostichopus atlanticus R. Perrier, 1902: 333, pl. 17 (figs 15–20). Mortensen, 1927: 387 (*passim*). Deichmann, 1930: 87.

Molpadiodemas atlanticus: Heding, 1940: 357.

Meseres atlanticus O'Loughlin, 1998: 493, 497.

Diagnosis

Large, sac-like, often flattened synallactid up to 170–180 mm long with no encrusting foreign bodies on skin, the latter smooth, naked. Anus in an inconspicuous furrow; mouth surrounded by 15–20 tentacles. Appendages minute, hair-like. Colour brown to grey to white. Large, round solid deposits with warty or spiny surface in skin; branching rods and reticulate plates in skin around mouth. Tentacle deposits prominent, including curved rods, often thickened in middle.

Material examined

SAM-A22156, WCP (34/16/vd), 2 specimens.

Description

Form cylindrical, U-shaped, anterior end extending beyond level of anus. Dorsal surface conspicuously arched. Length of larger specimen 80 mm, diameter of mid-body 15 mm. Dorsal and ventral surfaces not clearly demarcated. No adhering foreign bodies, except for a few *Globigerina* on ventral surface. Colour uniformly grey.

Mouth anterior; 15 tentacles in one specimen, 20 in the other. Tentacles distinctly peltate with a short stem and a large disc with few lateral projections. No collar or brim at anterior end. Anus situated in a furrow, indistinct due to the contraction of the posterior end of body.

Appendages minute, sparse, inconspicuous, few scattered dorsally, longer and in double rows ventrally, giving the mid-ventral ambulacrum a villus-like appearance. All appendages inconspicuous, hence body appears naked like that of a molpadiid.

Body wall thin, translucent, bearing externally a pleated appearance—the pleats traversing the body in all directions.

Calcareous deposits present in body wall, peristome, tentacles, papillae and gonadal tubules; absent from anal region. Body-wall spicules discoidal, mulberry-like plates, up to 0.2 mm in diameter (Fig. 4C), similar to that

illustrated by Perrier (1902, pl. 17 (fig. 20)). Such plates unusual, unlike anything seen in other holothuroids. Peristomial deposits (Fig. 4D) branching rods, branching resulting in complex reticulate structures almost impossible to remove whole; such plates and rods resemble those of the type illustrated by Perrier (1902, pl. 17 (figs 17-19)). Papillae deposits, few, appearing as simple smooth rods, without perforations (Fig. 4E). Tentacle deposits prominent, curved rods of a variety of forms, with or without perforations (Figs 4A, 16A),

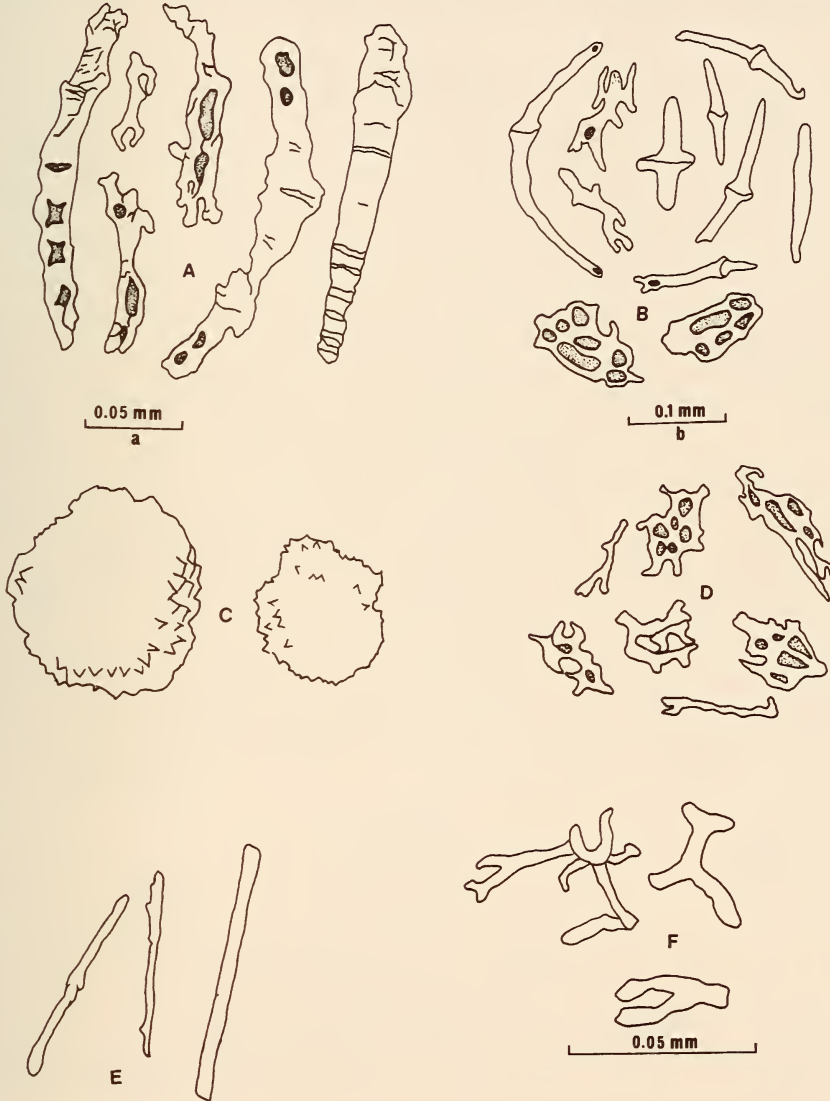


Fig. 4. *Meseres atlanticus* (R. Perrier). Spicules. A. Large rods from tentacle. B. Small rods from tentacle. C. Mulberry-like plates from body wall. D. Deposits from peristomial membrane. E. Rods from papillae. F. Rods from gonad. A—scale a; B-E—scale b.

the latter often with a swollen middle (Fig. 4B); some rods developed as perforated plates similar to those of the peristome. Minute simple smooth rods in the gonadal tubules (Fig. 4F).

Remarks

The two specimens come closer to *Pseudostichopus atlanticus* Perrier, 1902, than to any other species of the genus, agreeing with it in body form, the almost naked appearance of the skin, the presence of peculiar mulberry-shaped spicules

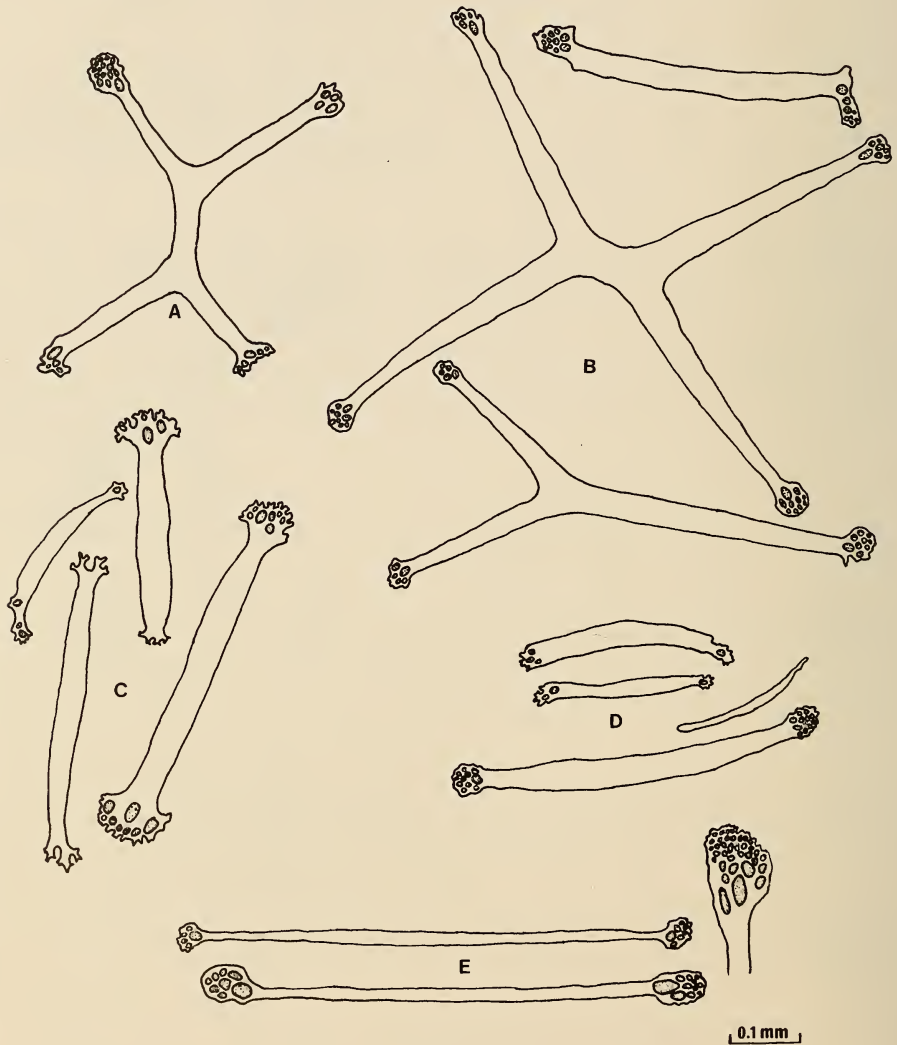


Fig. 5. *Orphnurgus protectus* (Sluiter). Spicules. A. Cross from anterodorsal body wall. B. Rods and crosses from ventral body wall. C. Tentacle deposits. D. Pedicel deposits. E. Papillae deposits.

in the skin, and the form of deposits in the tentacles and peristome. However, it differs in size (Perrier's specimens measured 170–180 mm in length), coloration, and the presence of some tentacle rods with a central thickening. Such differences are perhaps geographic variations as Perrier's specimens came from between the Azores and France, at a depth of 3 614 m. Deichmann (1930) recorded a single 95 mm specimen of this species from off Bequia in the West Indies, at a depth of 2 920 m. According to her, *P. villosus* Hérouard (*non* Théel), described in 1923 from Morocco, is also perhaps identical with Perrier's species.

Heding (1935) erected the genus *Molpadiodemas* for a similar species, *M. acaudum*, taken by the Danish Ingolf Expedition from the North Atlantic. He referred the genus to the family Gephyrothuriidae in the order Gephyrothurioidea (erected by him in 1931), close to the order Molpadioidea. However, Heding (1940), in his account of the holothuroids collected by the German Deep-Sea Expedition, abandoned the order Gephyrothurioidea and transferred the family Gephyrothuriidae back to the order Aspidochirotida, in which it was classified when erected by Koehler & Vaney (1905). To the genus *Molpadiodemas*, Heding (1940) further referred *Pseudostichopus atlanticus* Perrier, 1902, *P. occultatus* von Marenzeller, 1893, and *P. villosus* Théel, 1886. In 1942, Heding reaffirmed his earlier (1935) decision and commented that he had no doubt about the validity of the genus *Molpadiodemas* but hesitated to support his inclusion of the three other species he assigned to it in 1940.

Thandar (1992), in his comment on the status of the genus *Pseudostichopus*, suggested that it be removed from the family Gephyrothuriidae and transferred again to the Synallactidae in the order Aspidochirotida.

Rowe (*in* Rowe & Gates 1995), in error followed Heding's (1940) views on the Gephyrothuriidae. This was, however, corrected by O'Loughlin (1998) who restricted Gephyrothuriidae to the genera *Gephyrothuria* and *Hadalothuria*, and classified the family in the order Molpadiida; the remaining genera of the Gephyrothuriidae he transferred back to the Synallactidae. He further relegated *Molpadiodemas* to the synonymy of *Meseres* and accepted the validity of *P. atlanticus* as a distinct species of *Meseres*, in the combination *M. atlanticus* (R. Perrier, 1902).

Order ELASIPODIDA Hansen, 1975

Family Deimatidae Ekman, 1926

Orphnurgus protectus (Sluiter, 1901)

Figs 5, 16C–E

Scotodeima protectum Sluiter, 1901a: 20–21; 1901b: 61–62, pl. 2 (fig. 7), pl. 9 (fig. 4).

Orphnurgus protectus Hansen, 1975: 47.

Diagnosis (from Hansen 1975)

Tentacles 15, discs with irregular ramifications on the margin. Ventrolateral tube feet 24 pairs, midventral tube feet few and rudimentary. Dorsal papillae

22 pairs, in irregular double rows. Ventrolateral papillae 21 pairs. Spatulated crosses of body wall measuring 0.7 mm across. Spatulated rods densely packed in the slender and rigid papillae.

Material examined

SAM-A22158, WCP (34/16/vd), 2 fragments.

Description

Both fragments in poor state of preservation. Anterior fragment 48 mm long, 21 mm in width in broadest part of body; posterior fragment 37 mm long and 20 mm wide. Not possible to determine whether both fragments belong together and if they do whether they represent a complete specimen. Body wall thin, brittle as a result of numerous spicules. Colour dirty greyish white.

Mouth anterior, ventral. Tentacles 15, of unequal size—five large, five medium and five small, irregularly arranged with large ones anterior, medium on right side and small on left; all tentacles with contracted ramifications and no marginal knobs. Circum-oral papillae absent. Ventrolateral pedicels maximum of four pairs on anterior fragment; seven on right and five on left side of posterior fragment; however, left side of latter damaged, hence some pedicels possibly lost.

If both fragments represent a single specimen, it appears that there were no more than 11 pairs of pedicels. All pedicels short, stout, in two zigzag rows. Mid-ventral pedicels not observed.

Dorsal papillae—five pairs on anterior fragment and approximately five pairs on posterior fragment. Papillae thin, long, with a maximum length of 8 mm, decreasing slightly in size posteriorly.

Ventrolateral papillae—only three pairs detected with any degree of certainty, on anterior fragment; difficult to count on posterior fragment.

Due to the poor state of preservation of both the fragments, the numbers here given for both pedicels and papillae are approximate. All papillae rigid with spicules.

Internal anatomy little preserved; interior packed with *Globigerina*.

Spicules of body wall comprise spatulated crosses, tripartite deposits and rods; crosses (Figs 5A, B, 16C) up to 1.3 mm in length. Rods and tripartite deposits (Fig. 5B) only present in ventral body wall. Spatulated rods confined to pedicels (Figs 5D, 16D) and papillae (Fig. 5E), in the former up to 0.9 mm in length, in the latter up to 2.35 mm long. Tentacle deposits as more or less straight rods with expanded, spinulated and perforated ends, sometimes bifurcate (Figs 5C, 16E).

Remarks

This species resembles *Oneirophanta setigera* (Ludwig) with which it shares most of the characters, differing from it in the presence of tentacles with ramified processes and without marginal knobs on discs. According to Hansen (1975), the crosses of *O. setigera* measure up to 3 mm across whereas those of the single specimen of *Orphnurgus protectus* are only 0.7 mm across. The size of the crosses of the southern African material hence appears intermediate

between the two. Dr Gebruk, to whom my description and drawings were sent, concurs with my identification (pers. comm.) but is sceptical about the presence of rods in the ventral integument.

Distribution

Celebes Strait and west coast of South Africa, 1 301–3 255 m.

Family *Laetmogonidae* Ekman, 1926

Genus *Laetmogone* Théel, 1879

Hansen (1975) included four genera in the family but of these only the genus *Laetmogone* occurs in southern Africa, with only *L. fimbriata* (Sluiter, 1901) hitherto recorded. This species is not present in the collection at hand. Its record is that of Hansen (1975), based on 10 specimens (12–35 mm long) taken by the Galathea Expedition, off Durban. However, a single specimen in the present collection is new and has recently been described as *L. perplexa* (Thandar, 1998). In the number, form and distribution of pedicels and papillae and the maximum size (0.18 mm) of the wheels, the new species differs considerably from *L. fimbriata*, and can readily be distinguished with the aid of the key that follows. Since the new species is described elsewhere only the diagnosis is given below.

Key to the southern African species of *Laetmogone*

- 1A. Papillae conspicuous, white; pedicels crowded, slender from base to tip; large wheels usually (95 per cent) with 9 spokes *Laetmogone fimbriata* (Sluiter, 1901)
- 1B. Papillae inconspicuous, dark violet; pedicels not crowded, short, truncate, retractile into pockets; large wheels usually (72 per cent) with 10–12 spokes *Laetmogone perplexa* Thandar, 1998

Laetmogone perplexa Thandar, 1998

Fig. 15C, D

Laetmogone perplexa Thandar, 1998: 84, figs 2f–i, 4a–c.

Diagnosis (from Thandar 1998)

A large subcylindrical species, holotype 220 mm long. Colour uniform dark violet. Tentacles 15, slightly lobed. Pedicels 20 on each side, short, truncate, retractile into pockets, the latter situated on an indistinct brim, which also encircles mouth. Papillae minute (1 mm), retractile, about 25 on each side. Body wall spicules restricted to anterior and posterior ends; rods of varying shapes, 0.40–0.55 mm long; wheels not sharply differentiated into two types, diameter varying from 0.05 mm to 0.18 mm with mostly (72 per cent) four central rays and 10–12 spokes.

Family *Psychropotidae* Théel, 1882

This elaspodid family includes the genera *Benthodytes*, *Psychropotes* and *Psycheotrepes*, all erected by Théel (1882) and characterized by the presence of spicules, midventral pedicels, and a brim of fused pedicels surrounding the body. Only the former two genera are known from southern Africa, of which only *Benthodytes* is represented in the collection at hand.

Genus *Benthodytes* Théel, 1882

Benthodytes is characterized by soft retractile tentacles, circum-oral or post-oral papillae and the absence of an unpaired dorsal appendage. It includes eight species, of which *B. sanguinolenta*, *B. lingua*, *B. plana* and *B. typica* have hitherto been recorded from southern Africa. The R.V. *Africana II* material includes only *B. lingua*, two specimens herein referred to *B. valdiviae*, and a single incomplete specimen perhaps representing *B. typica*. A key to all five southern African species is provided.

Key to the southern African species of *Benthodytes*

- 1A. Spicules cross-shaped; dorsal papillae usually well developed 2
- 1B. Spicules rod-shaped or absent; dorsal papillae minute 4
- 2A. Brim narrow, often completely enclosed in body wall, body somewhat cylindrical *Benthodytes lingua* R. Perrier, 1896
- 2B. Brim broad, its margin forming the edge of the rather flattened body 3
- 3A. Anterior and posterior ends of body rounded; tentacular crown placed a considerable distance from anterior edge of body
..... *Benthodytes plana* Hansen, 1975
- 3B. Anterior and posterior ends of body somewhat tapered; tentacular crown adjoining anterior edge of body *Benthodytes valdiviae* Hansen, 1975
- 4A. Dorsal papillae numerous arranged in two bands; tentacles 18; post-oral papillae present *Benthodytes sanguinolenta* Théel, 1882
- 4B. Dorsal papillae few, arranged in two single rows; tentacles 15-20; circum-oral papillae present *Benthodytes typica* Théel, 1882

Benthodytes lingua R. Perrier, 1896

Fig. 6

Benthodytes lingua R. Perrier, 1896: 902; 1902: 456, pl. 12 (figs 1-2), pl. 21 (figs 1-9).
Deichmann, 1930: 124. Hansen, 1975: 80, pl. 9 (figs 3-5), pl. 12 (figs 2-3), text-fig. 29.

Benthodytes janthina Grieg, 1921: 11 (*non* von Marenzeller).

Pannychia glutinosa Hérouard, 1902: 32, pl. 4 (fig. 17).

Diagnosis (from Hansen 1975)

Body usually rounded in cross section. Skin usually thick and gelatinous. Tentacles 12–15, usually 12. Brim narrow, completely retractile. Ventral sole usually feebly delimited from remaining part of body. Dorsal papillae in single rows, up to 12 pairs, filiform or slightly conical. Dorsal deposits large crosses with bipartite apophyses, the two arms of which are outwardly curved and gradually tapered. Ventral deposits rudimentary or absent.

Previous southern African record

Locality unknown (Hansen 1975).

Material examined

SAM-A27716, WCP (33/16/vd), 1 specimen.

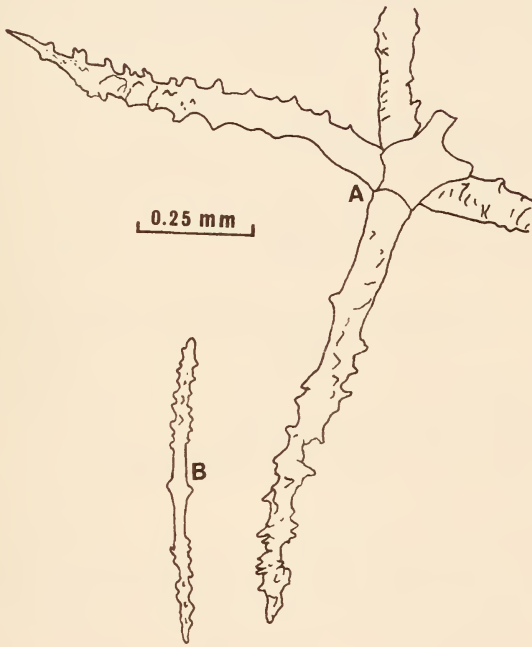


Fig. 6. *Benthodytes lingua* R. Perrier. Spicules. A. Cross-shaped rod with bipartite apophysis from dorsal body wall. B. Rod from anal region.

Description

Length 250 mm. Pedicels, dorsal papillae and brim not recognizable. Circum-oral papillae well developed. Each longitudinal muscle consisting of 4–7 strands, united at point of origin and insertion.

Spicules common only anteriorly and posteriorly—dominant type large crosses with bipartite apophyses (Fig. 6A), but latter rarely preserved, arms spinous (0.75–1.0 mm, usually 0.75 mm), spines increasing in density distally. Other spicules include crosses without apophyses, tripartite rods and spinous

rods (Fig. 6B); arms of crosses 0.35 mm long, spinous rods up to 0.6 mm long. Tentacles with rods, tripartite spicules and crosses, spinose at ends. Gonad with crosses and tripartite spicules without apophyses but with distally spinose arms.

Remarks

The only previous record of this species from southern Africa is that of Hansen (1975) based on seven specimens from an unknown locality. According to Hansen, the apophyses in this species are bipartite from the base but this could not be conclusively demonstrated in the few spicules in which the apophyses were intact. However, the size of the R.V. *Africana II* specimen, its cylindrical shape, thick gelatinous body wall, the type of tentacle discs, and the size and robustness of the deposits, all agree with Hansen's description of *B. lingua*. The closest relative of this species is the Eastern Pacific *B. incerta* from which it differs in its form, thick skin, well-developed circum-oral papillae and the absence of the characteristic crosses of the type illustrated by Hansen (1975: 79, fig. 28).

Local distribution

Off south-western Cape, 2 780–2 871 m.

General distribution

North and South Atlantic, 860–3 192 m.

Benthodytes valdiviae Hansen, 1975

Fig. 7

Benthodytes valdiviae Hansen, 1975: 82, figs 30–31.

Benthodytes lingua Heding, 1940: 368 (*non* R. Perrier).

Benthodytes janthina Heding, 1940: 368 (*non* von Marenzeller).

Diagnosis (from Hansen 1975)

Body flattened, somewhat tapered at both ends. Tentacle crowns adjoining anterior edge of body. Tentacles 12–15, usually 15. Brim broad, but retractile. Dorsal papillae 5–10 pairs, slender from base to tip. Deposits, dorsally large crosses with bipartite apophyses; ventrally absent, or reduced to small rods.

Previous southern African record

None.

Material examined

SAM-A27717, WCP (33/16/vd), 2 specimens.

Description

Specimens flattened, larger 42 mm long. Colour light violet to dirty grey. Tentacles dark purple, 15 in the larger and 12 in the smaller specimen. Tentacle crowns adjoining anterior edge of body. Circum-oral papillae, dorsal papillae

and mid-ventral pedicels not seen. Brim broad, pedicels of brim more or less completely fused, except anteriorly, but lateral canals often visible.

Dorsal spicules crosses (with apophyses), tripartite deposits and rods. Crosses of two types: one type large, similar to that described for *B. lingua*, with arms up to 0.8 mm long; other type (Fig. 7A, C, D) slender, with 4-5 smooth to slightly thorny arms, 0.35-0.60 mm long, with distally bipartite apophysis, feebly spinose at ends. Ventral spicules similar to dorsal, including crosses, tripartite spicules and spinose to smooth rods (Fig. 7B).

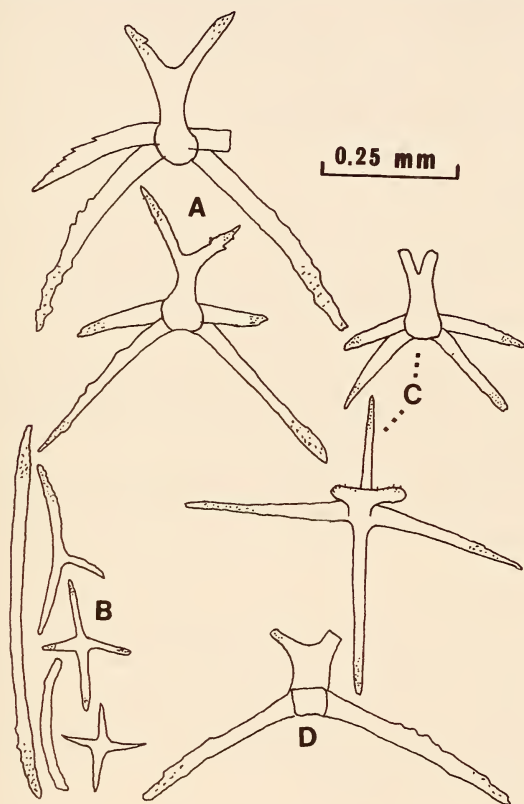


Fig. 7. *Benthodytes valdiviae* Hansen. Spicules. A. Cross-shaped rods with bipartite apophysis from dorsal body wall. B. Rods, crosses and tripartite deposit from ventral body wall. C. Cross-shaped rods from ventral body wall of second specimen. D. Same from dorsal body wall.

All drawn to same scale.

Remarks

Although the specimens are here referred to *B. valdiviae*, their flattened nature, free anterior pedicels and five-armed spicules suggest that they may belong to *B. plana*. However, since *B. valdiviae* differs from *B. plana* only in the shape of the body, the more anterior position of the tentacles and a greater robustness of the deposits (Hansen 1975), the present material is referred to it.

A point of some interest is that whereas *B. plana* appears to be an Indian Ocean species, currently known only from the east coast of southern Africa and from between Seychelles and Sri Lanka, *B. valdiviae* is probably Eastern Atlantic in distribution, formerly known from Canary Islands and now possibly off the Cape Peninsula, South Africa.

In the presence of two types of crosses with apophysis, it is quite unlike any other species except *B. incerta*. The latter species, however, is semicircular in cross section with a warty skin and peculiar crosses of the type illustrated by Hansen (1975: 79, fig. 28).

Local distribution

Off south-western Cape, 2 780–2 871 m.

General distribution

East Atlantic.

Benthodytes ?typica Théel, 1882

Fig. 8

Benthodytes typica Théel, 1882: 103, pl. 27 (fig. 7), pl. 35 (fig. 4), pl. 38 (fig. 5), pl. 44 (fig. 8); 1886: 2. Grieg, 1921: 10, pl. 3 (figs 6–7). Hérouard, 1923: 101, pl. 6 (fig. 4), text-fig. 8. Deichmann, 1930: 123.

Benthodytes papillifera Théel, 1882: 102, pl. 34 (fig. 14).

Benthodytes glutinosa R. Perrier, 1896: 902; 1902: 462–465, pl. 13 (fig. 5), pl. 20 (fig. 31). Koehler & Vaney, 1905: 72–74, pl. 12 (fig. 10). Grieg, 1921: 10, pl. 3 (figs 1, 2).

Benthodytes janthina Hérouard, 1923: 103.

Diagnosis (from Hansen 1975)

Tentacles 15–20, discs irregularly incised at the margin, and retractile into the stalks. Circum-oral papillae present. Brim well developed, the dark pigmented canals of the enclosed tube feet often clearly visible both from the dorsal and ventral side. Dorsal papillae minute and few, placed in a single row along the anterior part of the dorsal radii. Skin soft and usually covered in mucous. Deposits absent or rod-shaped.

Previous southern African records

Eastern Cape Province (33/32/vd), KwaZulu-Natal (29/33/vd), and Mozambique (14/45/vd).

Material examined

SAM-A22175, WCP (33/16/vd), 1 specimen.

Description

Specimen damaged, internal organs lost. Length 35 mm. Colour off-white. Tentacles 18, with marginal knobs on discs. Circum-oral papillae numerous. Other external structures not visible. Longitudinal muscles paired. Spicules of

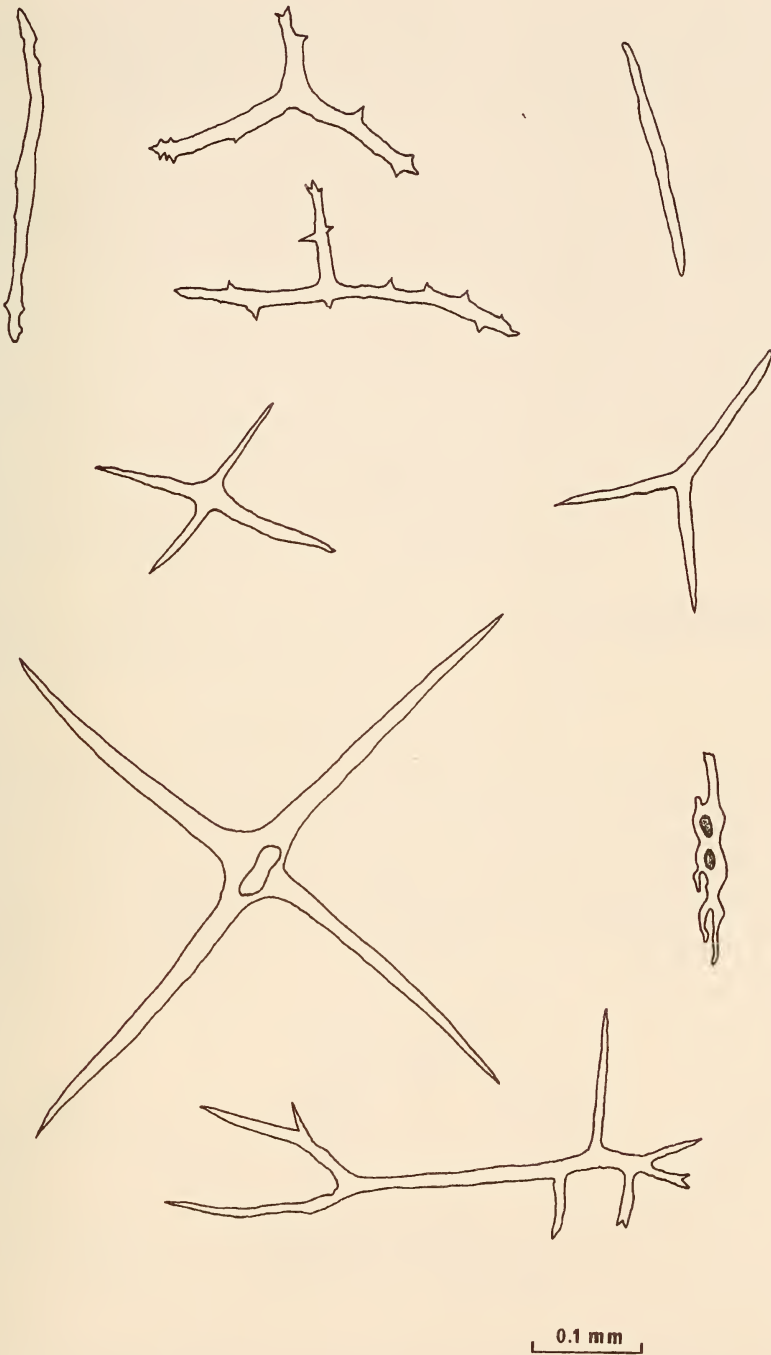


Fig. 8. *Benthodytes ?typica* (Théel). Rods from body wall.

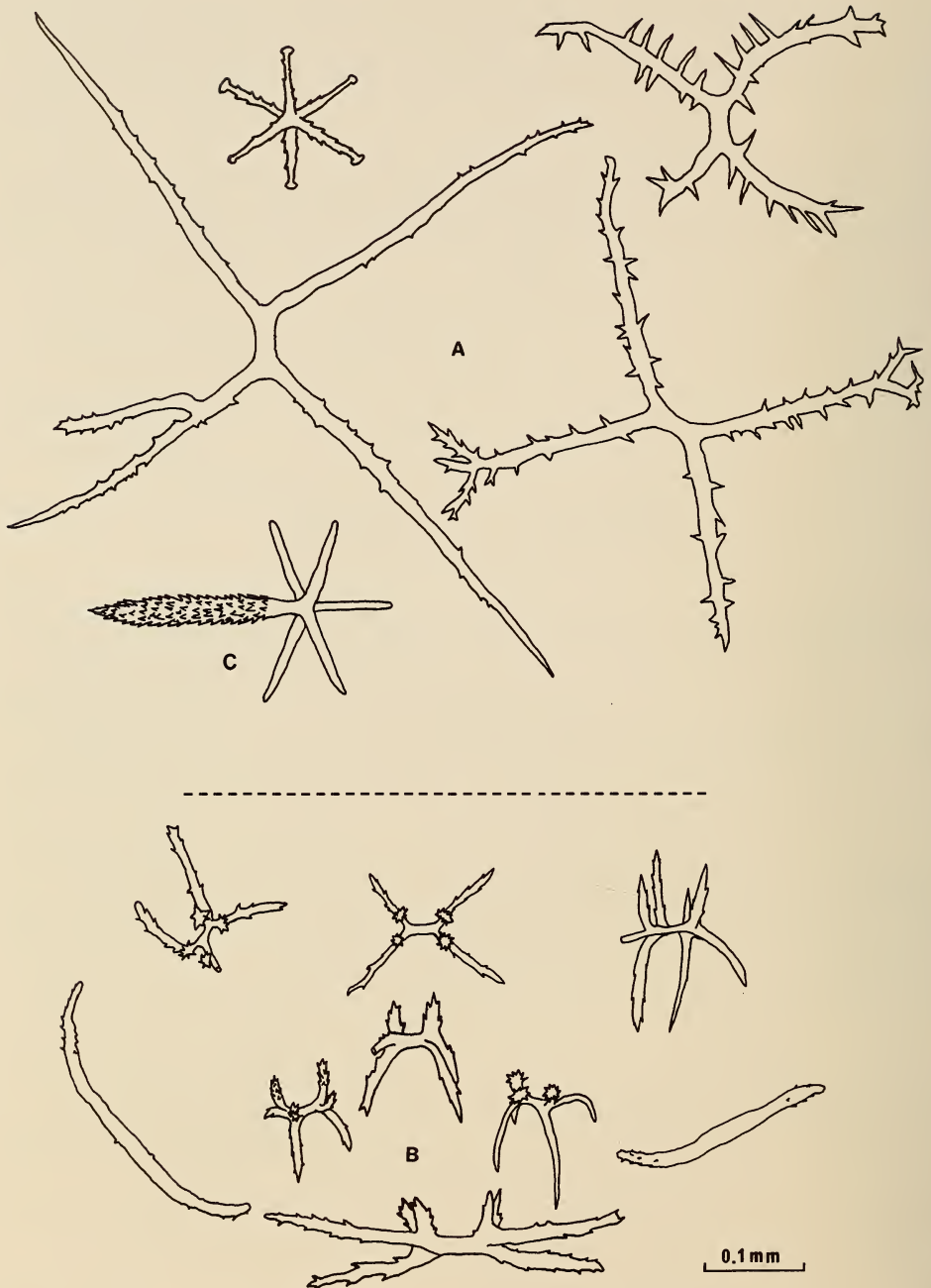


Fig. 9. *Peniagone* sp. indet. Deposits from body and podia. A. Crosses without apophyses. B. Rods and crosses with apophyses. C. Smooth cross with densely setose apophysis. All drawn to same scale.

body wall (Fig. 8) only rods and tripartite deposits, the former terminally spinulated, the latter either smooth or spinose. A single cross-shaped spicule with broken apophysis also observed, but this could be of foreign origin. Rods up to 0.35 mm long, longest arm of tripartite deposits up to 0.20 mm.

Remarks

The identity of this single incomplete specimen is in doubt due to the fragmentary nature and scarcity of the deposits. The specimen was initially thought to represent *B. sanguinolenta*, since this species was recorded by Clark (1923) from Cape Point. The description of the specimen and drawings of its spicules were sent to Dr Gebruk, who has since confirmed (pers. comm.) that it cannot represent *B. sanguinolenta*, which is always purple to violet in colour with spicules that are rather difficult to locate. According to him, the specimen may represent *B. typica*, since rods are the dominant type of spicules. Dr Gebruk further commented that the 'Presence of tripartite elements is not of significant value in this genus'. The presence of circum-oral papillae also supports the identity of this specimen. Additional cross-shaped deposits with apophysis, here suspected to be of foreign origin, could not be detected; they may prove that the specimen is referable to another species.

Distribution

Cosmopolitan, 1 873–4 700 m.

Family *Elpidiidae* Théel, 1879

This family comprises small elasipodid holothuroids with few tentacles (10–12), pedicels and papillae. Hansen (1975), who critically analysed the family, rejected the ideas expressed by Hérourard (1923) and Ekman (1926) that the genera represent two evolutionary lines. He reduced the number of genera from 13 to 10. Only the genera *Peniagone*, *Elpidia* and *Scotoplanes*, each represented by a single species, are here recorded from southern Africa for the first time.

Peniagone sp. indet.

Figs 9, 16F

Previous record

None.

Material examined

SAM-A22172, WCP (34/16/vd), 1 specimen (mutilated).

Description

Specimen badly mutilated, no external or internal characters preserved. Colour dirty yellowish-grey in alcohol. Deposits typical of genus, comprising mostly primary crosses with bent arms and apophyses and, in addition, large

spinous crosses without apophyses and curved spinous rods. Spinous crosses without apophyses (Figs 9A, 16F) are the commonest deposits and may represent pedicel spicules. Rare variations of these may be 3–6-armed with one or more arms branched at tips, length of stem 0.03–0.40 mm, length of arms 0.05–0.35 mm. Curved spinous rods scarce, 0.24–0.30 mm in length. Spinous 4-armed crosses with 2–4 apophyses (Fig. 9B) not common; length of stem 0.02–0.30 mm, apophysis length 0.05–0.27 mm, longest arm 0.06–0.16 mm; most apophyses short and arms usually strongly curved inwards. There may also be present smooth crosses with 1–4 apophyses, often much longer than the arms of the rods; when single apophysis present, this is densely setose (Fig. 9C). In addition, there are numerous other smooth crosses, with up to 0.8 mm long arms, and rods up to 2 mm in length, of possibly foreign (?sponge) origin.

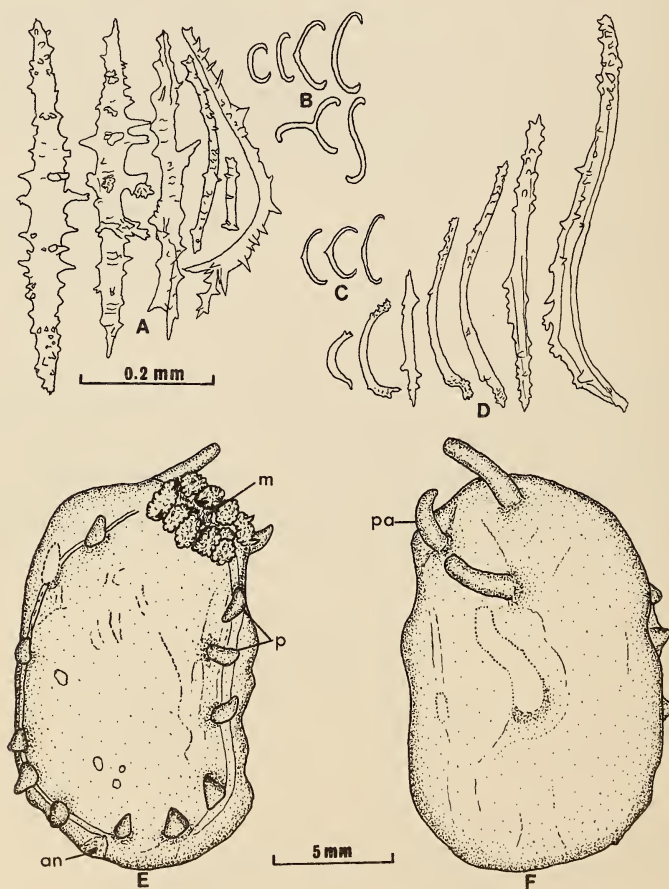


Fig. 10. *Scopalanes globosa* Théal. Entire specimen and spicules. A. Rods from body wall. B. C-, S- and Y-shaped deposits from body wall. C. C-shaped deposits from tentacles. D. Rods from tentacles. E. Ventral view of entire specimen. F. Dorsal view. All spicules drawn to same scale.

Remarks

Hansen's (1975) key to the species within the genus is based on several external characters that are lost in this mutilated specimen. However, my description of the material and drawings of spicules were sent to Dr Gebruk, who concurs that the specimen at hand definitely represents a *Peniagone* because of the 4-armed spicules with bent arms and apophyses. According to him, the colour of the specimen and the type and sizes of the crosses, indicate that the specimen is perhaps referable to *P. azorica* von Marenzeller from the North East Atlantic, and related to the Antarctic *P. purpurea* (Théel), *P. incerta* (Théel), *P. affinis* Théel and *P. willemoesi* (Théel). In fact, the writer was first inclined to consider the species as identical to the latter species or to *P. horrifera* Théel also from the Antarctic.

Genus *Scotoplanes* Théel, 1882

This genus includes only the type species *S. globosa* Théel and *S. clarki* Hansen, distinguished primarily by the presence of smooth skin with sturdy papillae in the former and warty skin with slender papillae in the latter. In southern Africa only the type species occurs, here reported for the first time.

Scotoplanes albida Théel, 1882, collected by the 'Challenger' from off the south-western Cape coast at 347 m is, according to Hansen (1975), probably referable to *Ellipinion* Hérouard, 1923.

Scotoplanes globosa (Théel, 1879)

Figs 10, 15F

Elpidia globosa Théel, 1879: 14, figs 17-19.

Elpidia murrayi Théel, 1879: 16, figs 23-25.

Scotoplanes globosa Théel, 1882: 29, pl. 4, pl. 5 (fig. 3), pl. 34 (figs 8-9), pl. 36 (figs 5-6), pl. 44 (fig. 12). Hansen, 1975: 167, pl. 9 (fig. 9), text-figs 83, 95 (4).

Scotoplanes murrayi Théel, 1882: 34, pl. 3 (figs 3-4), pl. 34 (fig. 2), pl. 44 (fig. 4).

Scotoplanes theeli Ohshima, 1915: 242; 1916-1919, 3 figs.

Diagnosis (from Hansen 1975)

Skin smooth. Dorsal papillae rather sturdy.

Previous southern African record

None.

Material examined

SAM-A22147, WCP (33/17/vd), 4 specimens.

Description

Largest specimen (Fig. 10E, F) 15 mm long. Colour grey. Pedicels 5-6 pairs, situated in distinct ventrolateral grooves. Only 2-3 papillae identifiable on right side, only anterior ones well preserved on left side.

Rods (Figs 10A, 15F) either slender with a few spines or robust with strongly developed, often ramified spines; slender rods up to 0.02 mm thick and about 0.40 mm long; stout rods up to 0.05 mm thick and 0.55 mm long; C-, S- and Y-shaped bodies (Figs 10B, 15F) 0.05–0.12 mm in length, delicate in smallest specimen. Tentacles with spinous rods (Fig. 10D) and C-shaped bodies (Fig. 10C).

Remarks

The present specimens are identical to Théel's species. Because of their poor state of preservation, no significance can be attached to the distribution of papillae. The rods, however, are similar to those of Hansen's material from the deepest Kermadec stations (5 850–6 770 m). Such rods can attain a maximum length of 1 mm as shown both by Théel (1882) and Hansen (1975).

Local distribution

Known only from off Cape Point, 2 268 m.

General distribution

Almost cosmopolitan but not yet known from the North Atlantic, 2 100–6 770 m.

Habitat

Diatom ooze, grey mud.

Genus *Elpidia* Théel, 1876

This genus is well characterized by its rod-shaped spicules with two pairs of obliquely placed horizontal arms and two vertical apophyses. The genus was formerly regarded as monotypic, but due to the work of mostly Hansen (1956, 1975) and Belyaev (1971, 1975), the genus currently contains 13 nominal and three unnamed species. Some scanty material collected off the south-west coast of southern Africa is here referred to *E. gracilis* Belyaev, 1975.

Elpidia gracilis (Belyaev, 1975)

Figs 11, 15E

Elpidia gracilis Belyaev, 1975: 266. Gebruk, 1993: 235.

Diagnosis (after Belyaev (1975) and Gebruk (1993); modified herein)

Body length up to 25 mm. Dorsal papillae three pairs, up to 9 mm long, decreasing posteriorly. Tube feet four pairs. Deposits varying from 0.65–1.20 mm, sometimes serrate. Diameter of axis 0.03–0.04 mm. Length of arms 35 per cent of shaft length. Apophyses straight and acicular, 10–78 per cent length of deposits. Tentacle deposits curved with reduced or absent arms and apophyses, 0.13–0.90 mm in length.

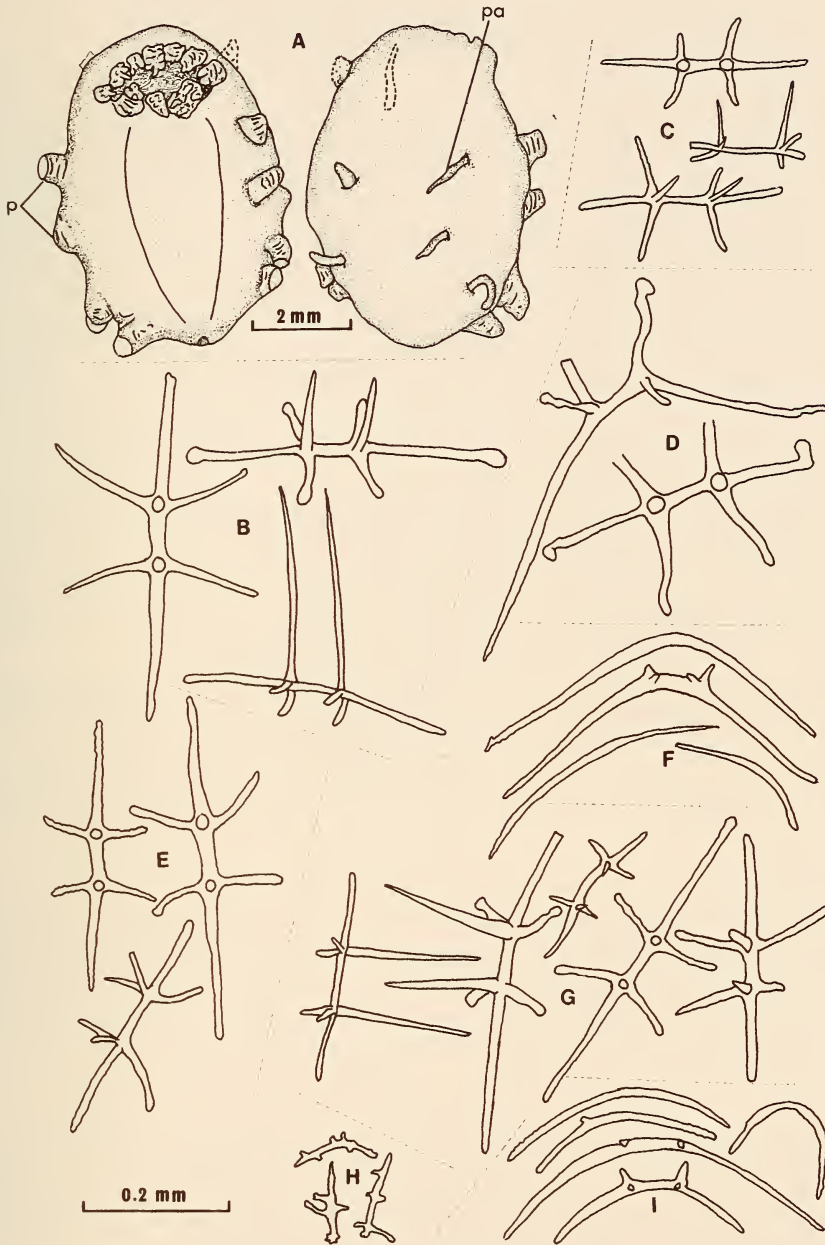


Fig. 11. *Elpidia gracilis* Belyaev. Structure and spicules. A. Ventral and dorsal views of complete specimen. B. Normal spicules of dorsal body wall. C. Developing spicules of dorsal body wall. D. Abnormal spicules of dorsal body wall. E. Normal spicules of ventral body wall. F. Tentacle spicules. G. Normal spicules from fragmented specimen. H. Branched rods from same. I. Tentacle spicules. All spicules drawn to same scale.

Material examined

SAM-A27715, WCP (33/16/vd), 1 specimen plus 2 fragments.

Description

Complete specimen (Fig. 11A) whitish in alcohol; length 7 mm, width 5 mm. Skin thin, delicate, ruptured at several points, apophyses of spicules projecting from skin all round. Mouth ventral, tentacles 10, short (c. 1 mm), truncate, with slender retractile processes; diameter of oral disc c. 30 per cent of body length. Anus terminal. Pedicels about 4 pairs—two short projections, one on each side of oral disc, may represent fifth pair of pedicels or are probably torn fragments of body wall. Papillae dorsal, only five counted with certainty, first definite pair between first definite pair of pedicels, second pair between second and third pair of pedicels, single posterior papillae on right side between third and fourth pairs of pedicels; longest papilla c. 1 mm long. An unpaired papilla-like structure at anterior end of left side may represent a sixth papilla or a torn piece of body wall.

Dorsal and ventral spicules (Figs 11B-E, 15E) slender and elongate, axis and arms smooth or slightly serrate with rounded extremities. Spicules 0.16–0.65 mm long, longest dorsal spicule 0.65 mm (Fig. 11B), longest ventral spicule (Fig. 11E) 0.50 mm; maximum diameter of axis of dorsal spicules 0.03 mm, of ventral spicules 0.02 mm. Arms up to 31 per cent length of spicule; extremities of some spicules bent off plane (Fig. 11D).

Apophyses straight, acicular, of dorsal spicules 0.050–0.285 mm long or 18–78 per cent length of spicules, of ventral spicules 0.045–0.070 mm long or 12–21 per cent length of spicules. Some spicules abnormal with strongly curved axis and arms of unequal length (Fig. 11D). Tentacle spicules (Fig. 11F) 0.20–0.45 mm, slightly or strongly curved with both arms and apophyses reduced and/or absent.

Fragments

Tentacles as in complete specimen. Body wall spicules (Fig. 11G) 0.175–0.520 mm long; diameter of axis 0.02 mm. Arms up to 32 per cent length of spicules. Apophyses 0.018–0.205 mm long or 10–62 per cent length of spicules. Irregularly branched rods (Fig. 11H), 0.11–0.13 mm in length also present. Tentacle spicules (Fig. 11I) as in complete specimen, 0.130–0.445 mm long.

Remarks

Of the two fragments, the posterior was contained in the same vial as the complete specimen, whereas the anterior fragment was included with a synaptid in another vial that contained four labels, as follows: everted part of holothurian; sac-like holothurian; SAM, A189C, 25 August 1959; and SAM, A190N, 26 August 1959. It is certain that the second and last labels belong together and refer to the elpidiid since the station number and date of collection are the same as those of the complete specimen and the remaining fragment. The two fragments most probably belonged to a single specimen.

The southern African material is here referred to *E. gracilis* Belyaev because of short papillae, smooth as well as serrate extremities of spicules and

Table 1. Comparison of characters of the type specimens of *Elpidia gracilis* with the southern African form.

Character	Type	South African
Length	6.4-25 mm	7 mm
Width	14 mm	5 mm
Pedicels	4 pairs	4-(?) pairs
Papillae	3 pairs, in anterior half of body or throughout body length	?3 pairs; in posterior half of body
Papillae length	up to 9 mm (adults), 1.5 mm (juvenile)	up to 1 mm (? juvenile)
Oral disc	20-30% body length	30% body length
<i>Spicules</i>		
Longest dorsal spicule	1.2 mm	0.65 mm
Longest ventral spicule	0.8 mm	0.5 mm
Maximum diameter of axis	dorsal: 0.04 mm ventral: 0.03 mm	dorsal: 0.03 mm ventral: 0.02 mm
Arms	length 35% of shaft; smooth, occasionally serrate at extremity	length 37% of shaft; smooth or serrate at extremity
Apophyses	0.15-0.20 mm (20-70% length of spicules)	0.020-0.285 mm (10-78% length of spicules)
Tentacle spicules	length 0.8-0.9 mm, arms short, or absent, apophyses well developed	length 0.13-0.45 mm, arms and apophyses reduced or absent

arms, length of arms relative to the axis, and the form and maximum size of the apophyses. However, there are slight differences, initially considered to be geographic variations worthy of subspecific ranking (Thandar 1984). These differences (summarized in Table 1) include the presence of papillae in the posterior rather than the anterior half of the body, the short maximum size of the spicules, the slightly narrower diameter of the central axis of the spicules and the shorter and less-developed tentacle deposits. According to Dr Gebruk (pers. comm.) these differences fall within the range of variation of the species and do not support the establishment of geographical subspecies. Hence the original diagnosis of the species is here modified to include not only the southern African form but also a single well-preserved specimen described recently by Gebruk (1993).

The soft thin nature of the skin and the extremely slender spicules with well-developed acicular apophyses are reminiscent of *E. theeli* Hansen, *E. minutissima* Belyaev, *E. chilensis* Belyaev and *E. adenensis* Belyaev. However, whereas both *E. theeli* and *E. minutissima* have spicules up to 0.60 and 0.80 mm in length respectively, the diameter of the central axis is 0.02 mm with the apophyses 20-50 per cent the length of the spicules in *E. theeli* and only 25-35 per cent in *E. minutissima* (Hansen 1975). Further, *E. theeli* has

5–7 pairs of long (12 mm) papillae. *Elpidia adenensis* is characterized by smooth spicules up to 1.25 mm long, with the diameter of axis as 0.02 mm and the apophyses only 7–15 per cent the length of the spicules. Like *E. gracilis*, *E. chilensis* also has smooth to serrate spicules but its apophyses are only 10–14 per cent the length of the spicules and there are only two pairs of papillae.

Elpidia gracilis has only previously been recorded from South Orkney Islands and trench at 5 450–6 145 m. According to Dr Gebruk (pers. comm.), the species also occurs in the North Atlantic.

Local distribution

South-western Cape Province, 2 268–2 377 m.

General distribution

South Orkney Island and trench, and the Atlantic Ocean.

Order MOLPADIIDA Haeckel, 1896

Family Gephyrothuriidae Koehler & Vaney, 1905

Gephyrothuria alcocki Koehler & Vaney, 1905

Fig. 12

Gephyrothuria alcocki Koehler & Vaney, 1905: 78, pl. 5 (figs 6–8).

Himasthlephora glauca Clark, 1907: 40, 184, pl. 13 (figs 1–4).

Gephyrothuria europeensis Hérouard, 1923: 30, pl. 9 (figs 10a, b).

Gephyrothuria glauca Deichmann, 1930: 202.

Diagnosis (modified from O'Loughlin 1998: 495)

Tentacles 15, each with 2–3 pairs of digits, mouth terminal, anterior, anal furrow present with anal canal extension. Papillae long, up to five pairs, with ampullae. Papulae present, some drawn out into papillae-like extensions, at least posteriorly. Calcareous ring with three dorsal interradials. Gonadal tubes with up to four sac-like branches. Males with prominent mid-dorsal genital papillae at anterior end. Spicules absent.

Material examined

SAM-A22140, WCP (34/16/vd), 2 specimens.

Previous southern African record

None.

Description

Specimen SAM-A22140a. Body form cylindrical, barrel-shaped (Fig. 12A). Mouth and anus terminal. Length 23 mm, height in mid-body 8 mm. Mouth open, bordered by 15 tentacles, each with 2–4 lobes. Anterior end constricted

and slightly turned up. Skin thin, translucent, ribbed. Calcareous ring clearly visible through body wall. Dorsal papillae—only five identified with any degree of certainty. A papilla-like structure on skin covering the calcareous ring may represent genital papilla. Of the five dorsal papillae, three situated anteriorly, and two in the middle of the body. A papilla-like structure behind the three anterior papillae may represent a sixth papilla. Largest papillae about 3 mm. Anal papillae distinct. Porous skin in region of anus and mouth may be evidence of retracted podia. Ribs on surface of body can be confused with papillae adhering on to body surface. Colour uniformly grey, including tentacles and papillae.

Calcareous ring well developed, radial and interradial plates well calcified and weakly fused (Fig. 12B). External appearance of ring suggests 15 plates but dissection revealed only 10 plates—five radials, each with paired anterior projections and five interradials, each with a single anterior projection; radials, in addition, with paired anterior depressions for tentacle attachment. All plates roughly rhomboidal in shape and posteriorly concave.

Polian vesicle single, elongate. Stone canal not seen. Gonad in two tufts of 5–6 terminally bifurcate tubes per tuft. Both respiratory trees short, right one more so, each with few lobes. Longitudinal muscles unpaired, clearly visible through translucent body wall. Gut filled with *Globigerina*.

Spicules absent in body wall, appendages and tentacles.

Specimen SAM-A22140b. Length 22 mm, breadth in mid-body 6 mm. Colour grey speckled with a black substance of possibly foreign origin. Mouth and anus terminal, the former slightly turned up due to the constricted anterior

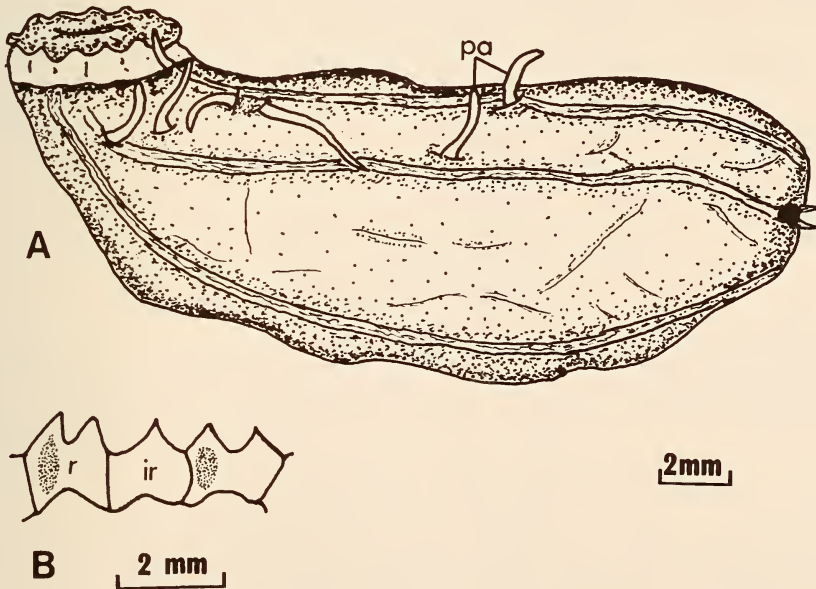


Fig. 12. *Gephyrothuria alcocki* Clark. A. Entire specimen. B. Two radial and one interradial plates of calcareous ring.

Table 2. Comparison of principal characters of the holotypes of *Gephyrothuria* with the southern African form.

Character	<i>Gephyrothuria alcocki</i> Koebler & Vaney (type)	<i>Gephyrothuria glauca</i> (Clark) (type)	South African form
Length	50 mm	± 20 mm	23 mm
Width	17-18 mm	8 mm	8 mm
Colour	rose	grey	grey
Tentacle lobes	2	4	2-4
Papillae	3-5 prs (5-6 mm long)	4-6 prs (5-6 mm long)	3-4 prs (3 mm long)
Pediceal-like outgrowths	absent	present	present
Genital papillae	?	prominent	prominent (in one spec.)
Polian vesicle	single, 4 mm	?	single
Stone canal	free	?	?
Gonadal tubules	branched	unbranched	branched
Distribution	Atlantic	Indo-Pacific	South Africa

end. Body form cylindrical, barrel-shaped. Mouth bordered by 15 tentacles, each with 2–4 digits. Anal papillae distinct. Dorsal papillae four pairs, longest about 2 mm in length. Pedicel-like structures crowded posteriorly, sparse anteriorly. Genital papillae absent. Calcareous ring, as in specimen A22140a, each radial plate with a pore for radial nerve. Spicules absent.

Remarks

Because of the presence of a tail-like process, Clark (1907) described his material as a new species and assigned it to the genus *Himasthlephora* erected for this purpose. He, however, suspected that this process could be an ejected part of the gut. Hence Hérourard (1923) declared *Himasthlephora* a junior subjective synonym of *Gephyrothuria*, a genus erected by Koehler & Vaney (1905) for their *G. alcocki*; in this he was supported by Deichmann (1930). Hérourard (1923), in addition, described *G. europeensis* which, according to Deichmann (1930), is clearly conspecific with *G. glauca*. Thandar (1992), citing Rowe (pers. comm.), considered that *G. alcocki* and *G. glauca* may be conspecific. O'Loughlin (1998) synonymized *G. glauca* with *G. alcocki* after examining material from different localities. He retained the genus in the family Gephyrothuriidae and the order Molpadiida, together with the genus *Hadalothuria*.

The southern African material, although scant, is well preserved. In its size, coloration, number of tentacle-lobes, presence of pedicel-like outgrowths and the genital papilla (in at least one specimen) appears to be identical with Clark's form. However, both specimens lack an extension to the anal canal. Differences between the southern African material and both Koehler & Vaney's (1905) and Clark's (1907) specimens are summarized in Table 2.

This is the first record of this species from the southern Atlantic Ocean.

Distribution

Atlantic Ocean, 1 316–3 678 mm.

Family Molpadiidae Müller, 1850

Genus *Molpadia* Risso, 1826

This more or less cosmopolitan genus is represented in southern Africa by *Molpadia millardae*, here described as new to science, and *M. capensis* Heding, 1935. Two specimens of an indeterminate species in the present collection are also referred to this genus.

Key to the southern African nominal species of *Molpadia*

- 1A. Calcareous ring without significant sculpturings, radial plates with or usually without posterior bifurcations; body wall spicules exclusively tables *Molpadia millardae* sp. nov.
- 1B. Calcareous ring deeply sculptured, radial plates with posterior bifurcations; body wall spicules fusiform rods, plates and tables *Molpadia capensis* Heding, 1935

Molpadia millardae sp. nov.

Figs 13, 15G

Diagnosis

Total length up to 29 mm; tail up to one-third body length, often shorter. Colour dirty grey, anterior end (oral disc) and tail whitish to grey. Tentacles 15 with usually 3 digits, including unpaired one which is the largest. Calcareous ring without significant sculpturings, radial plates often with a long, posterior prolongation. Longitudinal muscles paired. Phosphatic deposits absent. Spicules exclusively tables with a solid spire derived from three pillars fused for most of their length. Body wall tables with usually 3–6, sometimes more (up to 12) perforations, average diameter 0.15 mm; tail tables rod-like, average length 0.30 mm, with up to 12 holes, often fewer.

Etymology

The species is named after Dr Naomi Millard, formerly of the South African Museum, for making the R.V. *Africana II* and other material available to me.

Material examined

Holotype. SAM-A22163, off south-western Cape Province, R.V. *Africana II* Stn A 322, 34°36'S 17°00'E, 2 745 m, 10 December 1959.

Paratypes. SAM-A27711, same data as holotype, 3 specimens; SAM-A22168, Stn A 318, 33°52'S 16°51'E, 2 525–2 782 m, 8 December 1959 2 specimens; SAM-A22169, Stn A 315, 34°37'S 17°03'E, 2 891–2 965 m, 8 December 1959, 1 specimen; A22174, Stn A 319, 34°05'S 16°58'E, 2690–2 727 m, 8 December 1959, 1 specimen.

Description

Holotype. Specimen small, total length 22 mm (including tail), diameter of body 11 mm, tail roughly one-third body length. Colour of body dirty grey, anterior end (oral disc) and tail whitish to grey. Radii with five longitudinal lines demarcating positions of longitudinal muscles. Tentacles retracted, digits not visible. Mouth terminal, circular, in centre of oral disc. Body wall thin, somewhat translucent and gritty to the touch; oral disc and skin around mouth rigid due to well-formed calcareous ring.

Internal organs poorly preserved, interior filled with sand and *Globigerina*. Calcareous ring well developed (Fig. 13E), radial and interradiial plates not fused and without significant external sculpturing; anterior margin of ring scalloped, each radial plate notched anteriorly once and slightly prolonged posteriorly to form a rudimentary process; interradiial plates each with two anterior notches. Longitudinal muscles distinctly paired.

Body wall spicules exclusively tables (Fig. 13F, G) with small discs (average diameter 0.14 mm) with 3–6, usually 3, large holes, additional holes alternating with three primary ones; spire high (0.09–0.15 mm), composed of three pillars solidly fused at apex. Tail spicules (Fig. 13H) tables with elongate, rod-like or fusiform discs (average length 0.27 mm) with up to 12, but usually

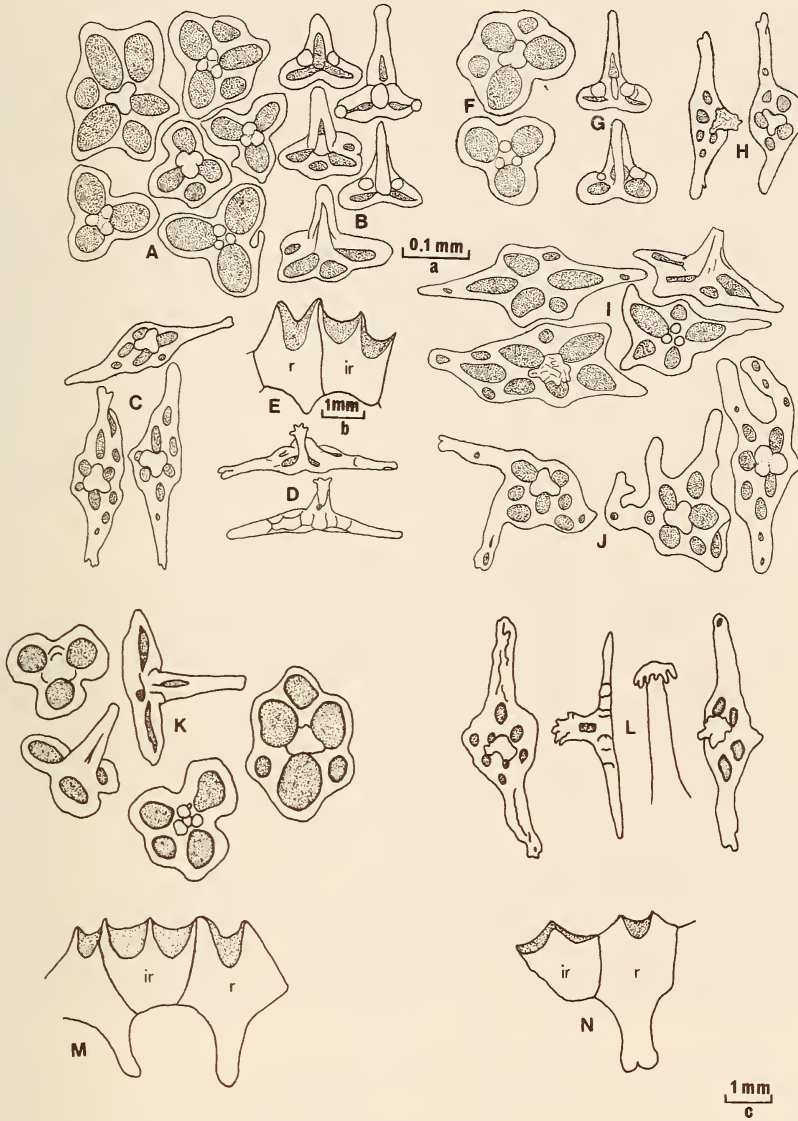


Fig. 13. *Molpadia millardae* sp. nov. Spicules. A. Tables from body wall of paratype SAM-A27711. B. Same from side. C. Tables from tail of paratype SAM-A27711. D. Same from side. E. Part of calcareous ring of holotype, SAM-A22163. F. Tables from body wall of holotype. G. Same from side. H. Tables from tail of holotype. I. Tables from anterior body wall of holotype. J. Tables from base of tail of holotype. K. Spicules from body wall of paratype SAM-A22168. L. Spicules from tail of same. M. Part of calcareous ring of same. N. Part of calcareous ring of paratype SAM-A27711. All spicules drawn to scale a; E—scale b; M, N—scale c.

less than 10 holes; spire low with three discrete pillars or pillars solidly fused together, terminating in few blunt teeth.

Table discs of anterior body wall large, somewhat irregular, slightly elongate (up to 0.33 mm), with usually more than six holes (Fig. 13I). Table discs from base of tail equally long and irregular but with pseudopodia-shaped extensions, usually pierced by several small holes (Fig. 13J). Phosphatic deposits absent.

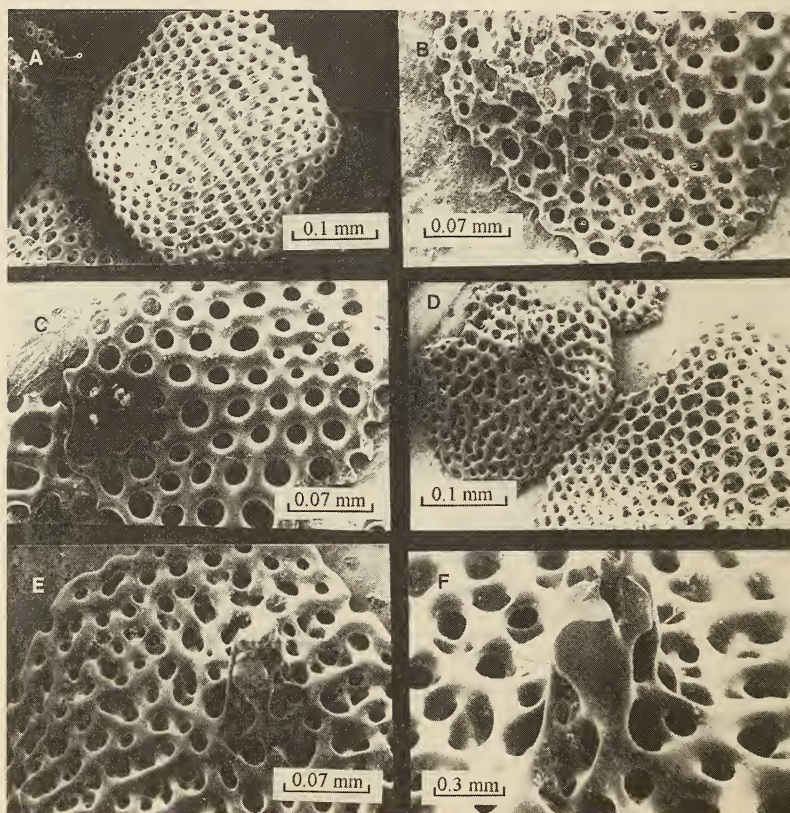


Fig. 14. SEM micrographs of spicules of R.V. *Africana II* holothuroids. A. Thecal plate (undersurface) of *Echinocucumis hispida*. B. Part of same (upper surface) to show spire. C. Another plate of *E. hispida* (undersurface). D. Thecal plate of *Ypsilothuria bitentaculata*. E. Same enlarged to show spire. F. Spire enlarged.

Paratype, SAM-A27711. Total length of largest specimen 21.5 mm; diameter of body 10 mm, tail about one-quarter body length. Radial plates of calcareous ring of dissected specimen with long, terminally bifurcate, posterior prolongations (Fig. 13N). Longitudinal muscles paired. Body wall tables (Fig. 13A, B) sometimes scarce, discs with up to 12 perforations, often fewer; tail tables (Fig. 13C) common, with elongate discs, with up to 10, sometimes occluded holes.

Paratype, SAM-A22168. Both specimens poorly preserved and damaged. Total length of larger specimen 20 mm, tail about one-third body length. Radial plates of calcareous ring with long posterior process, not terminally bifurcate (Fig. 13M). Longitudinal muscles paired. Body wall tables with discs up to 0.25 mm and 3–6 holes (Fig. 13K). Tail table discs (Fig. 13L) up to 0.35 mm in length, with up to eight holes. Some table spires very long, of three pillars, totally fused together and with terminal cluster of several downwardly directed spines (Fig. 13L). Smaller specimen damaged, about 13 mm in total length.

Paratype, SAM-A22169. Largest specimen in collection—total length 29 mm, diameter of body 12 mm, tail length 5 mm. Tentacles 15, each with about three digits, unpaired digit the largest. Radial plates of calcareous ring each with a long posterior process, not terminally bifurcate. Longitudinal muscles paired. Gonad filled with large eggs. Body wall tables with disc up to 0.25 mm in length, with 4–8 perforations. Tail tables up to 0.35 mm in length with about five central perforations and a low, sometimes arched spire.

Paratype, SAM-A22174. Total length 27 mm, tail about half body length. Body wall tables not common, discs up to 0.15 mm in length with usually 3–6, usually 3, perforations. Tail table discs long, up to 0.4 mm in length, with up to six large central holes.

Remarks

The new species has close similarities with the Antarctic *Molpadia abyssicola* Pawson, 1977. On first examination, the South African material was referred to this species, albeit with some hesitation (see Thandar 1984). On examination of more material, there appears to be sufficient grounds to regard the southern African material as a new species. It differs from *M. abyssicola* in its size, coloration, smaller tail tables, and the very significant paired nature of the longitudinal muscles. Pawson's species is stated to reach a total length of 105 mm, and is purple or white in colour, with tail tables having an average length of 0.36 mm with up to 20 holes, and undivided longitudinal muscles. In contrast, the largest (mature, female) specimen of *M. millardae* reaches a total length of only 29 mm, all specimens are greyish in colour, the tail tables have an average length of 0.30 mm with only up to 12 holes. There is, however, no doubt that both species are closely related.

It may also be argued that both are geographical variants of the same species, but the above differences speak against this conclusion. Since an adult female measures only 29 mm in total length it does not seem likely that the new species grows to any appreciable size.

The calcareous ring illustrated for the holotype may be abnormal with its arrested posterior processes to the radial plates since at least three paratype dissected show distinct processes to the radial plates. This is in direct contrast to *M. abyssicola* in which Pawson concluded that the ring with long processes to the radial plates in the holotype was abnormal as no such processes were evident in his dissected paratypes.

In the small size of the tables, the present specimens approach also *M. blakei* Théel but, judging from both Deichmann's (1930) and Pawson's (1977) illustrations of the spicules of this species (the latter from the holotype),

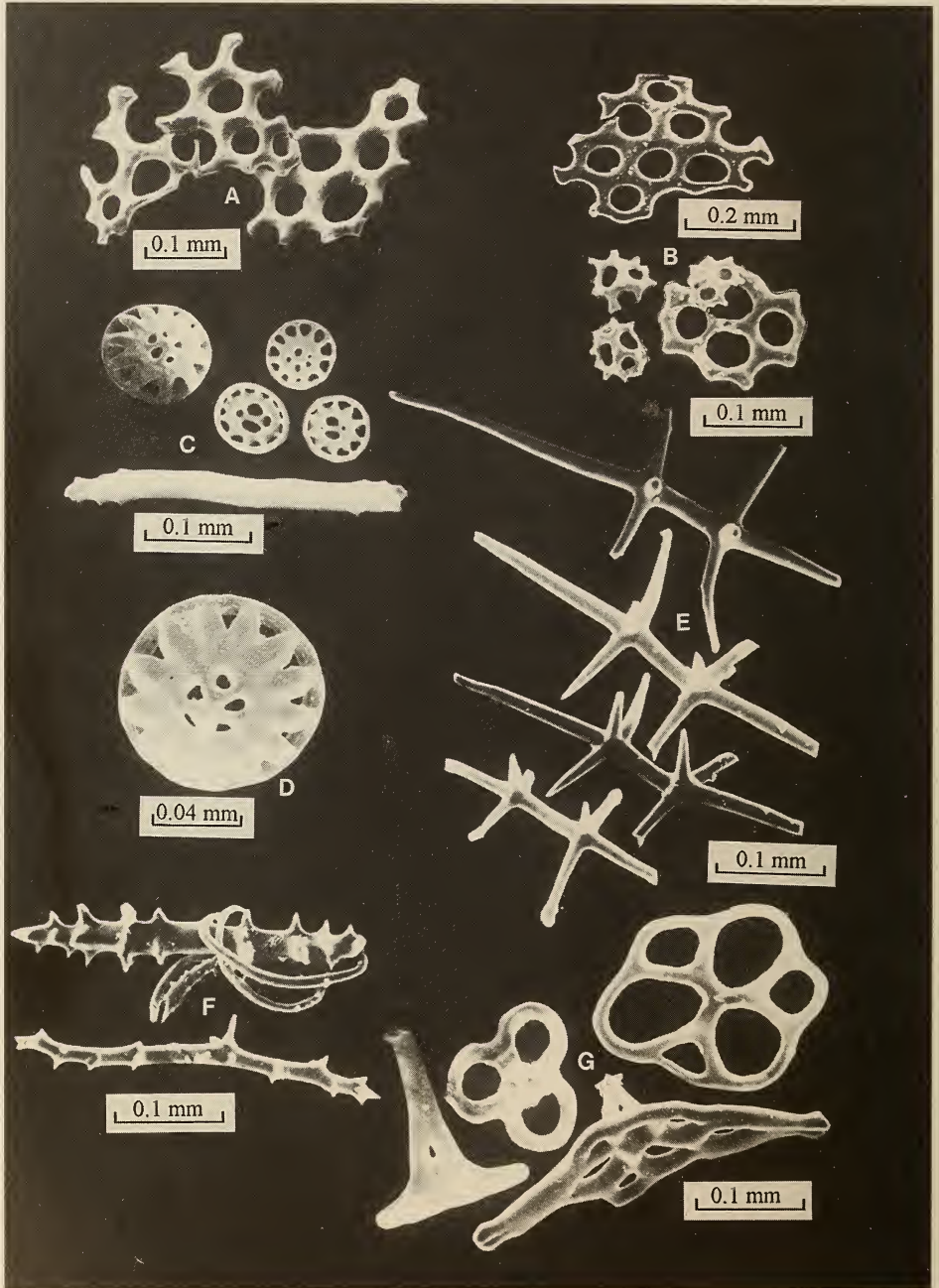


Fig. 15. SEM micrographs of spicules of R.V. *Africana II* holothuroids. A. *Psolidothuria octodactyla*, holotype. B. *Paracucumaria capense*, holotype. C. *Laetmogone perplexa*, holotype. D. Single wheel of same (enlarged). E. *Elpidia gracilis*. F. *Scotoplanes globosa*. G. *Molpadia millardae* sp. nov., holotype.

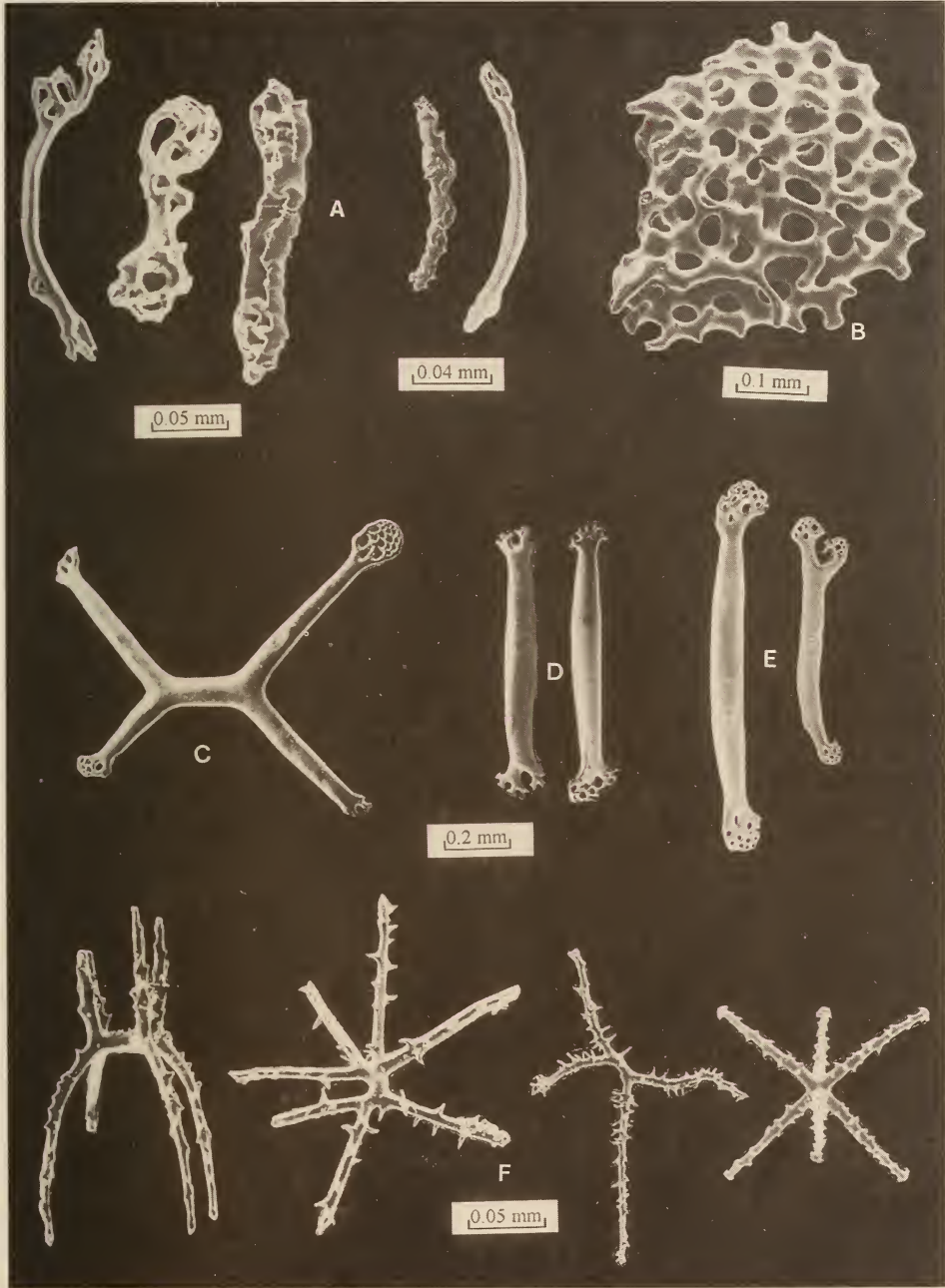


Fig. 16. SEM micrographs of spicules of R.V. *Africana II* holothuroids. A. Tentacle spicules of *Meseres atlanticus*. B. Complex plate from *Psolidium vitreum*. C-E. *Orphnurgus protectus*. C. Cross from body wall. D. Pedicel deposits. E. Tentacle deposits. F. Crosses from *Peniagone* sp. indet.

the spires of the body wall tables are extremely long with downwardly directed teeth. Only one such table was observed in one of the paratypes of the new species here described. *Molpadia millardae* also comes quite close to *M. granulata* (Ludwig) (= *M. bathybia* Clark), but Pawson (1977), who synonymized these species, stated that *M. granulata* has body wall tables with six or more (up to 20) perforations. In addition, *Molpadia granulata* reaches a length of 110 mm, is brownish-yellow in colour and has larger table discs in both the body and the tail.

Pawson's (1977) supposition that those molpadiids without phosphatic deposits always have undivided radial muscles must be discounted unless larger specimens of the new species are found with phosphatic deposits.

This is a second record of a molpadiid from southern Africa. The first is that of Heding (1935) who presented a rather incomplete description of his *M. (Paramolpadia) capensis*, collected by the Ingolf Expedition from the Western Cape Province.

Distribution

South-western Cape Province, South Africa, 2 525–2 965 m.

Molpadia sp. indet.

Material examined

SAM-A22141, WCP (34/16/vd), 2 specimens.

Description

Form and colour as in *M. millardae*; tail absent (?lost). Length 16 mm and 23 mm.

Calcareous ring small, radial plates about twice as wide as interradial plates, notched at both ends, posterior processes absent. Each interradial plate with a blunt, triangular, anterior projection and an indented posterior margin. Longitudinal muscles unpaired. Spicules absent (?dissolved).

Remarks

Since the specimens lack a tail and spicules, it is not possible to determine their specific identity. Although their general appearance (except for the smooth skin) and coloration are identical to *M. millardae*, the form of the calcareous ring and muscles suggest that they belong to another species.

Distribution

Off Cape Point, 2 688–2 725 m.

ACKNOWLEDGEMENTS

I thank the late Drs Tom Barry and Naomi Millard, formerly of the South African Museum, for the opportunity to study and report on this interesting collection. I am indebted to Dr Frank Rowe, formerly of the Australian

Museum in Sydney, for his critical advice and guidance during my Ph.D. studies, and Dr Adrian Gebruk, of the Academy of Sciences, Russia, for verifying my identifications and for other useful comments. Financial assistance from the University of Durban-Westville and the Foundation for Research Development, towards part of this research, is gratefully acknowledged.

REFERENCES

- ANON. 1963. *Annual Report. Division of Sea Fisheries. South Africa* 31: 1-242.
- BARRETT, L. 1856. Description of four new species of Echinodermata. *Annals and Magazine of Natural History* (2) 20: 46-48.
- BELYAEV, G. M. 1971. Deep water holothurians of the genus *Elpidia*. In: BOGOROV, V. G. ed. *Fauna of the Kurile-Kamchatka Trench and its environment. Trudy Instituta Okeanologii. Akademiya NAUK SSSR* 92: 326-367.
- BELYAEV, G. M. 1975. New species of *Elpidia* from the South Atlantic. *Trudy Instituta Okeanologii. Akademiya NAUK SSSR* 103: 259-280.
- CLARK, H. L. 1907. The apodous holothurians. *Smithsonian Contributions to Knowledge* 35: 1-206.
- CLARK, H. L. 1923. The echinoderm fauna of South Africa. *Annals of the South African Museum* 13: 221-435.
- DAY, J. 1967. *A monograph on the Polychaeta of southern Africa* 1. London: British Museum (Natural History).
- DEICHMANN, E. 1930. The holothurians of the western part of the Atlantic Ocean. *Bulletin of the Museum of Comparative Zoology at Harvard College* 71 (3): 41-226.
- DEICHMANN, E. 1948. The holothurian fauna of South Africa. *Annals of the Natal Museum* 11 (2): 325-375.
- EKMAN, S. 1926. Systematisch-phylogenetische Studien über Elasipoden und Aspidochiroten. *Zoologische Jahrbücher (Anatomie)* 47: 429-540.
- FISHER, K. W. 1907. The holothurians of the Hawaiian Islands. *Proceedings of the United States National Museum* 32: 637-744.
- GEBRUK, A. 1993. New data on elasipodid fauna of South Atlantic and Antarctic. *Trudy Instituta Okeanologii, Akademiya NAUK, SSSR* 127: 228-244.
- GRIEG, J. A. 1921. Echinodermata. *Report on the Scientific Results of the 'Michael Sars' North Atlantic Deep Sea Expedition* (3) 2: 1-47.
- HANSEN, B. 1956. Holothurioidea from depths exceeding 6000 meters. *Galathea Report* 2: 33-54.
- HANSEN, B. 1975. Systematics and biology of the deep sea holothurians. I. Elasipoda. *Galathea Report* 13: 1-262.
- HEDING, S. G. 1931. On the classification of the molpadids. *Videnskabelige Meddelelser fra Dansk naturhistorisk Forening i Kjøbenhavn* 92: 275-284.
- HEDING, S. G. 1935. Holothurioidea. Part I. Apoda-Molpadioidea, Gephyrothurioidea. *Report on the Danish Ingolf-Expedition* 4 (9): 1-84.
- HEDING, S. G. 1940. Die Holothurien der deutschen Tiefsee-Expedition. II. Aspidochirote und Elasipode Formen. *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer 'Valdivia' 1898-1899* 24 (3): 317-375.
- HEDING, S. G. 1942. Holothurioidea. Part II. Aspidochirota, Elasipoda, Dendrochirota. *Report on the Danish Ingolf-Expedition* 4 (13): 1-39.
- HÉROUARD, E. 1902. Holothuries provenant des campagnes de la 'Princesse-Alice' (1892-1897). *Resultats des campagnes scientifiques accomplies par le Prince Albert I* 21: 1-61.
- HÉROUARD, E. 1923. Holothuries provenant des campagnes de la Princesse Alice et L'Hirondelle II (1898-1915). *Resultats des Campagnes Scientifique accomplies par le Prince Albert I* 66: 1-163.
- KOEHLER, R. & VANEY, C. 1905. Holothurioidea. An account of the deep-sea Holotheroidea collected by the Royal Indian Marine Survey Ship 'Investigator'. *Echinoderma of the Indian Museum*. Calcutta: Trustees of the Indian Museum.

- LUDWIG, H. 1893. Vorläufigen Bericht über die auf den Tiefsee Fahrten des 'Albatross' (Frukling 1891) im östlichen Stillen Ocean erbeuteten Holothurien. *Zoologischer Anzeiger* 16: 177-186.
- LUDWIG, H. 1894. Reports on an exploration off the west coasts of Mexico, Central and South America, and off the Galapagos Islands, in charge of Alexander Agassiz, by the U.S. Fish Commission Steamer 'Albatross' during 1891. 12. The Holothurioidea. *Memoirs of the Museum of Comparative Zoology at Harvard College* 17 (3): 1-183.
- LUDWIG, H. 1901. Arktische und subarktische Holothurien. *Fauna Arctica* 1 (1): 135-178.
- LUDWIG, H. & HEDING, S. G. 1935. Die Holothurien der Deutschen Tiefsee Expedition. Fusslose und dendrochirote Formen. *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer 'Valdivia' 1898-1899* 24: 123-214.
- MAHONEY, R. 1966. *Laboratory techniques in zoology*. London: Butterworths.
- MORTENSEN, TH. 1927. *Handbook of the echinoderms of the British Isles*. London: Oxford University Press.
- OHSIMA, H. 1915. Report on the holothurians collected by the United States Fisheries steamer 'Albatross' in the Northwestern Pacific during the summer of 1906. *Proceedings of the United States National Museum* 48 (2073): 213-291.
- O'LOUGHLIN, P. M. 1998. A review of the holothurian family Gephyrothuriidae. In: MOOI, R. & TELFORD, M. eds. *Echinoderms. Proceedings of the 9th International Echinoderm Conference*, San Francisco, August 1996: 493-498. Rotterdam: Balkema.
- PANNING, A. 1949. Versuch einer Neuordnung der Familie Cucumariidae (Holothurioidea, Dendrochirota). *Zoologische Jahrbücher* 78: 404-470.
- PAWSON, D. L. 1965. The bathyal holothurians of the New Zealand region. *Zoology Publications from Victoria University College* 39: 1-33.
- PAWSON, D. L. 1977. Molpadiid sea cucumbers (Echinodermata: Holothuroidea) of the Southern Atlantic, Pacific, and Indian Oceans. *Biology of the Antarctic Seas VI. Antarctic research series* 26: 97-123.
- PERRIER, E. 1886. *Les explorations sous-marines*. Paris.
- PERRIER, R. 1896. Sur les élasipodes recueillis par le 'Travailleur' et le 'Talisman'. *Compte rendu Hebdomadaire des Séances de l'Académie des Sciences, Paris* 123: 900-903.
- PERRIER, R. 1902. Holothuriers. *Expéditions Scientifiques du 'Travailleur' et du 'Talisman'*. Paris 1902: 273-554.
- ROWE, F. W. E. & DOTY, J. E. 1977. The shallow-water holothurians of Guam. *Micronesica* 13 (2): 217-250.
- ROWE, F. W. E. & GATES, J. 1995. Echinodermata. In: WELLS, A. ed. *Zoological catalogue of Australia* 33: 1-510. Melbourne: CSIRO Australia.
- SARS, M. 1859. Om tre nye Holothurider af hvilke den ene danner Typus for en nys Slaegt. *Forhandlinger i Videnskabselskabet i Kristiania* 1959: 170-179.
- SARS, M. 1861. Oversight at Norges Echinodermer. *Forhandlinger i Videnskabselskabet i Khristiania* 1861: 1-166.
- SLUITER, C. PH. 1901. Die Holothurien der Siboga-Expedition. *Siboga-Expeditie, Monographie* 44: 1-141.
- THANDAR, A. S. 1984. The holothurian fauna of southern Africa. Unpublished Ph.D. thesis, University of Durban-Westville, South Africa.
- THANDAR, A. S. 1991. The cucumariid holothurians of southern Africa with the erection of a new genus. *South African Journal of Zoology* 26 (3): 115-139.
- THANDAR, A. S. 1992. The South African Museum's Meiring Naude cruises. 18. Holothuroidea. *Annals of the South African Museum* 101 (7): 159-180.
- THANDAR, A. S. 1998. A new genus and three new species of deep sea holothuroids from the west coast of South Africa (Echinodermata). *Journal of Zoology, London* 244: 79-88.
- THÉEL, H. 1879. Preliminary report on the Holothuridae of the exploring voyage of H.M.S. 'Challenger' I. *Bihang till Kongl. svenska vetenskapsakademiens handlingar* 5 (19): 1-20.
- THÉEL, H. 1882. Report on the Holothurioidea dredged by H.M.S. *Challenger* during the years 1873-1876. Part I. *Report of the Scientific Results of the Voyage of H.M.S. 'Challenger'*, (Zoology) 4 (13): 1-176.

THÉEL, H. 1886. Report on the Holothurioidea. Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico (1877-1878), in the Caribbean Sea (1879-1880), and along the eastern coast of the United States during the summer of 1880, by the United States Coast Survey Steamer 'Blake'. *Bulletin of the Museum of Comparative Zoology at Harvard College* 13: 1-21.

ABBREVIATIONS

an—anus
cl—cloaca
cr—calcareous ring
ir—interradial plate
lrt—left respiratory tree
m—mouth
o—oesophagus
p—pedicel/tube foot

pa—papilla
pv—polian vesicle
r—radial plate
re—rectum
rm—retractor muscle
rrt—right respiratory tree
t—tentacle
wvr—water vascular ring